LOS ANGELES HARBOR BACTERIA TMDL

INNER CABRILLO BEACH AND MAIN SHIP CHANNEL

APRIL 30, 2004

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1 INTRODUCTION

This Staff Report documents the development of a Total Maximum Daily Load to address impairments of water quality standards by coliform and beach closures at Inner Cabrillo Beach and the Los Angeles Harbor Main Ship Channel. The Staff Report describes the waterbodies, their beneficial uses, and bacterial objectives for supporting the beneficial uses; summarizes water quality data documenting the impairments; discusses sources of coliform and their linkage to water quality; develops wasteload and load allocations; and sets forth an implementation plan to attain water quality standards.

This TMDL encompasses two separate areas of the Los Angeles Harbor: the Main Ship Channel and Inner Cabrillo Beach. They are included together in order to meet the requirements of the consent decree for TMDL development in the Los Angeles Region (United States District Court, Northern District of California, 1999). And while both areas are part of the same body of water, Regional Board staff understands the different uses, interests and environmental goals of the different the areas. The implementation schedule will address the unique features of both areas.

Inner Cabrillo Beach is exceptional among Los Angeles area beaches in several ways. First, Inner Cabrillo Beach is one of just a few protected ocean beaches where the swimming beach is calm. Second, the swimming beach is located in a very urban and industrialized area, actually within the Los Angeles Harbor, the busiest port in the US, and abutting the urban area of San Pedro within the city of Los Angeles. And third, in addition to the beach facilities themselves, the swimming beach, picnic areas, volleyball courts, playground etc. it is located in the midst of other notable recreational and wildlife habitat assets including the Cabrillo Beach Bathhouse, the Cabrillo Beach Fishing Pier, and the boat docks. Nearby are other recreational facilities, Cabrillo Beach Youth Waterfront Sports Center, outer Cabrillo Beach, popular for scuba diving and windsurfing and Cabrillo Marina and 22nd St Landing. Additionally, directly at Inner Cabrillo Beach is the educational institution, the Cabrillo Marine Aquarium. There is a man-made saltwater marsh and a constructed shallow water habitat in addition to eelgrass beds.

The Los Angeles Harbor is an exceptional commercial asset for the City of Los Angeles. The Port is very large; the complex occupies 7500 acres of land and water along 43 miles of waterfront and more than 3000 vessels move through the Port of Los Angeles every year making it the busiest port in the United States. The Main Ship Channel sees most of that ship traffic as it is between the inner Harbor which incorporates many of the basins and slips and the outer Harbor where Inner Cabrillo Beach is located.

Unfortunately, both Inner Cabrillo Beach and the Main Ship Channel often have high levels of indicator bacteria, frequently exceeding bacterial standards, and indicating the potential for causing disease in those who come in contact with the water. This serious state of affairs is particularly true at the swimming beach, Inner Cabrillo Beach. This TMDL is intended to bring Inner Cabrillo Beach and the Los Angeles Harbor Main Ship Channel in line with the established standards and provide a healthy swimming beach and robust natural environment.

1.1 Regulatory Background

The State of California's principal water quality law is the Porter-Cologne Water Quality Act (Porter Cologne). Porter Cologne is implemented in the Los Angeles Region by the California Water Quality Control Plan, Los Angeles Region (Basin Plan). The Basin Plan sets water quality standards for the Los Angeles Region, which include beneficial uses for surface and ground water with the numeric and narrative objectives necessary to support those uses, and the state's antidegradation policy. The Basin Plan also describes implementation programs to protect all waters in the region. The Basin Plan, along with the Water Quality Control Plan for Ocean Waters of California (Ocean Plan), serves as the State Water Quality Control Plan for Cabrillo Beach and the Los Angeles Harbor.

These plans are required by and in compliance with the federal Clean Water Act (CWA). Section 303(d)(1)(A) of the CWA requires each state to conduct a biennial assessment of its waters, and identify those waters that are not achieving water quality standards (Los Angeles Regional Water Quality Control Board, 2003a). The resulting list is referred to as the 303(d) list. The CWA also requires states to establish a priority ranking for waters on the 303(d) list of impaired waters and to develop and implement Total Maximum Daily Loads (TMDL) for these waters.

A TMDL specifies the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards, and allocates the pollutant loadings to point and nonpoint sources. The elements of a TMDL are described in 40 CFR 130.2 and 130.7 and Section 303(d) of the CWA, as well as in U.S. Environmental Protection Agency guidance (U.S. EPA, 1991). A TMDL is defined as the "sum of the individual waste load allocations for point sources and load allocations for nonpoint sources and natural background" (40 CFR 130.2) such that the capacity of the waterbody to assimilate pollutant loads (the loading capacity) is not exceeded. TMDLs must take into account seasonal variations and include a margin of safety to address uncertainty in the analysis (40 CFR 130.7(c)(1)). Finally, states must develop water quality management plans to implement the TMDLs (40 CFR 130.6).

The U.S. EPA has oversight authority for the 303(d) program and is required to review and either approve or disapprove the state's 303(d) list and each TMDL developed by the state. If the state fails to develop a TMDL in a timely manner or if the U.S. EPA disapproves a TMDL submitted by a state, EPA is required to establish a TMDL for that waterbody (40 CFR 130.7(d)(2)).

As part of its 1996 and 1998 regional water quality assessments, the Regional Board identified over 700 waterbody-pollutant combinations in the Los Angeles Region where TMDLs would be required (LARWQCB, 1996, 1998). A 13-year schedule for development of TMDLs in the Los Angeles Region was established in a consent decree (Heal the Bay Inc., et al. v. Browner, et al. C 98-4825 SBA) (United States District Court, Northern District of California, 1999) approved on March 22, 1999.

For the purpose of scheduling TMDL development, the decree combined the over 700 waterbody-pollutant combinations into 92 TMDL analytical units. Analytical Unit 72 lists Cabrillo Beach (Inner) and the Los Angeles Main Ship Channel as impaired due to "Beach Closures (coliform)" and "Beach Closures". The consent decree also prescribed schedules for certain TMDLs, and according to this schedule, a bacteria TMDL for Cabrillo Beach (Inner) and the Los Angeles Main Ship Channel required to be completed by March 2005. Under the terms of the consent decree, USEPA must either approve a TMDL written by the State of California or establish its own, by March of 2005.

As required by the CWA and Porter-Cologne, The Basin Plan includes beneficial uses of Los Angeles Regional waters, water quality objectives to protect those uses, an antidegradation policy, collectively referred to as water quality standards, and other policies necessary to implement water quality standards. As they are approved, TMDL implementation plans are incorporated into the Basin Plan.

Staff proposes a 'reference system/antidegradation approach' as the implementation procedure for this TMDL. The Santa Monica Bay Beaches and Marina del Rey Harbor Mother's Beach, like Cabrillo Beach and the Los Angeles Harbor, include the REC-1 (Water Contact Recreation) as a beneficial use (Los Angeles Regional Water Quality Board, 2003b; 2002a 2002b). The recent TMDLs for these beaches use this approach to implement the bacteria objectives of the Ocean Plan and the Basin Plan.

The 'reference system/antidegradation approach' allows a certain number of days when the single sample bacteria objectives are exceeded. The number is based on historical exceedance levels at existing monitoring locations, in comparison to a local reference beach. This approach is proposed in recognition of the fact that there are natural sources of bacteria that may cause or contribute to exceedances of the single sample objectives and that it is not the intent of the Regional Board to require needless treatment or diversion of natural sources of bacteria. Staff recognize that there may be a balance between beneficial uses for the impaired waterbodies such as water contact recreation (REC-1) and aquatic life and wildlife, which are also part of other beneficial uses at Cabrillo Beach and the Main Ship Channel such as MAR (Marine Habitat) and WILD (Wildlife Habitat).

As described in detail in section 6.2.1, staff propose to use Leo Carrillo Beach and its associated drainage area, Arroyo Sequit Canyon, as the local reference system until other reference approaches are evaluated and the necessary data collected to support the use of alternative reference locations when the TMDL is revised in four years. Arroyo Sequit Canyon is the most undeveloped subwatershed in the Santa Monica Bay watershed with

98% open space and little evidence of human impact. In essence, the reference approach recognizes natural sources and focuses this TMDL to set waste load allocations and load allocations such that anthropogenic sources of bacteria do not cause or contribute to exceedances of bacteria water quality standards.

The reference beach approach, as set forth, ensures that water quality is at least as good as that of the reference beach. In addition, this approach recognizes and is consistent with state and federal antidegradation policies, such that where existing water quality is better than that of the reference beach, no degradation of existing water quality is permitted.

1.2 ENVIRONMENTAL SETTING

1.2.1 Geographic Setting

The Cabrillo Beach area and the Los Angeles Harbor are in the southern part of Los Angeles County, within the City of Los Angeles and are part of the Dominguez watershed. The Dominguez watershed encompasses approximately 345 square kilometers (133 square miles) of land and water (Dominguez Watershed Advisory Committee, 2003) (Figure 1-1).

Inner Cabrillo Beach and the Los Angeles Harbor Main Ship Channel open up into the Outer Los Angeles Harbor. The Los Angeles Harbor is approximately 25 miles south of downtown Los Angeles and lies between the Palos Verdes Peninsula and the mouth of the Los Angeles River. The Harbor is protected by two large breakwaters which separate it from the Pacific Ocean. Between these two breakwaters is the 1,200 foot wide entrance to the Los Angeles Harbor. The Dominguez Channel empties into the Los Angeles Harbor via the Inner Los Angles Harbor and the Main Ship Channel.

The Los Angeles Harbor is sited on a relatively flat filled marshland of the Los Angles River Delta. The Harbor area is in the lee of the Palos Verdes peninsula and the Palos Verde Hills which rise to 451 meters (1,480 feet).

Figure1-1 Geographic Setting, Cabrillo Beach and Main Ship Channel

1.2.2 Cabrillo Beach Facilities

Cabrillo Beach is divided into the Outer Cabrillo Beach, located where the outer breakwater joins with the Palos Verdes peninsula, and Inner Cabrillo Beach. Inner Cabrillo Beach includes a swimming area consisting of a small pocket beach on the inside corner of the breakwater. The swimming beach, bounded on the south by the breakwater and the north by a rock groin perpendicular to the beach, is approximately 1,100 feet in length and totals approximately 8 acres. Inner Cabrillo Beach also includes a northern portion used primarily for non-contact water recreation.

Inner Cabrillo Beach is an important urban recreational and educational site. Approximately 1.4 million people use the area every year (based on parking in 2003, S. Vogel, Cabrillo Marine Aquarium, personal communication). Cabrillo Beach offers a protected sand beach for swimming, picnic areas, barbecue grills, volley ball courts, public restrooms and a playground, attracting approximately 700,000 people in a year (lifeguard counts, 2003, S. Vogel, Cabrillo Marine Aquarium, personal communication). Inner Cabrillo Beach attracts families with young children where the children can swim in the calm waters of the protected beach.

Additionally, a public boat launch and dock is north of the beach separated from the beach by a rock groin. Personal watercraft also use the boat launch and may also land on the north end of the swimming beach, itself.

The Cabrillo Beach Fishing Pier is east of Inner Cabrillo Beach along the rock groin of the breakwater.

The Cabrillo Marine Aquarium, a facility of the City of Los Angeles Department of Recreation and Parks, is located at Cabrillo Beach. The Aquarium is an educational and research facility with 245,000 – 370,000 number of visitors per year (S. Vogel, Cabrillo Marine Aquarium, personal communication) and numbers of programs for children and adults, including numbers of school field trips. There is an aquarium expansion project currently in progress that will include a Marine Research Library, Aquaculture Research lab and an Exploration Center.

The Cabrillo Beach Bathhouse is a Mediterranean style building built in 1932 which has recently been restored for use as a public facility for community meetings and events. On the northern portion of Cabrillo Beach is the Cabrillo Beach Youth Waterfront Sports Center. For a long time this facility was a Boy Scout camp, now it is operated by the Learning for Life educational program as a youth, aquatic center which provides aquatics and camping for children in Southern California.

Outer Cabrillo Beach is on the outerside of the breakwater and is popular for wind surfing and scuba diving. Outer Cabrillo Beach is also listed in the 2002 303 (d) list for “Beach Closures” and “High Coliform Count”(Los Angeles Regional Water Quality

Control Board, 2002a). and has been included in the Santa Monica Bay Beaches Bacteria TMDL. The Santa Monica Bay Beaches Bacteria TMDL includes 44 ocean beaches from the Los Angeles/Ventura County line to Outer Cabrillo Beach in the south and was adopted by the Regional Board in 2002 and approved by EPA in June 2003 (Los Angeles Regional Water Quality Control Board, 2002b)

In the Los Angeles Harbor, just north of the Cabrillo Beach, is the Cabrillo Marina, encompassing 42.4 acres of land and 38.9 acres of water, which accommodates both large and small recreational vessels, with 885 permanent boat slips. Also nearby is the commercial area, the 22nd Street Landing, which has large diving and fishing fleets including whale watching boats.

The Los Angles Harbor is administrated by the City of Los Angles as the Port of Los Angeles. The Port complex occupies 7500 acres of land and water along 43 miles of waterfront. More than 3000 vessels move through the Port of Los Angeles making it the busiest port in the United States. Top containerized imports are furniture and apparel and top containerized exports are wastepaper and resins/plastics. The Port receives more than one million cruise passengers annually, making it the busiest cruise passenger complex on the west coast. The newest land addition to the port, constructed primarily in 1994 and 1995 is the 590 acre Pier 400 which is now a proprietary container terminal for Maersk Sealand.

1.2.3 Land Use

The Dominguez watershed is urban and approximately 62% of the land surface is impervious, with drainage primarily through the storm drain system to the Dominguez Channel and the Los Angeles Harbor (DWAC, 2003). The Palos Verdes Hills are residential and runoff directly to Cabrillo Beach.

1.2.4 Climate

The area has a mediterranean climate, warm summers mild winters rain occurring primarily November through April. The annual rainfall for a typical dry year and wet year are 5.53 inches and 20.67 inches, respectively (see Appendix A).

1.2.5 Habitat

Marine habitats at Cabrillo Beach include (Figure 1-2):

The beach, itself.

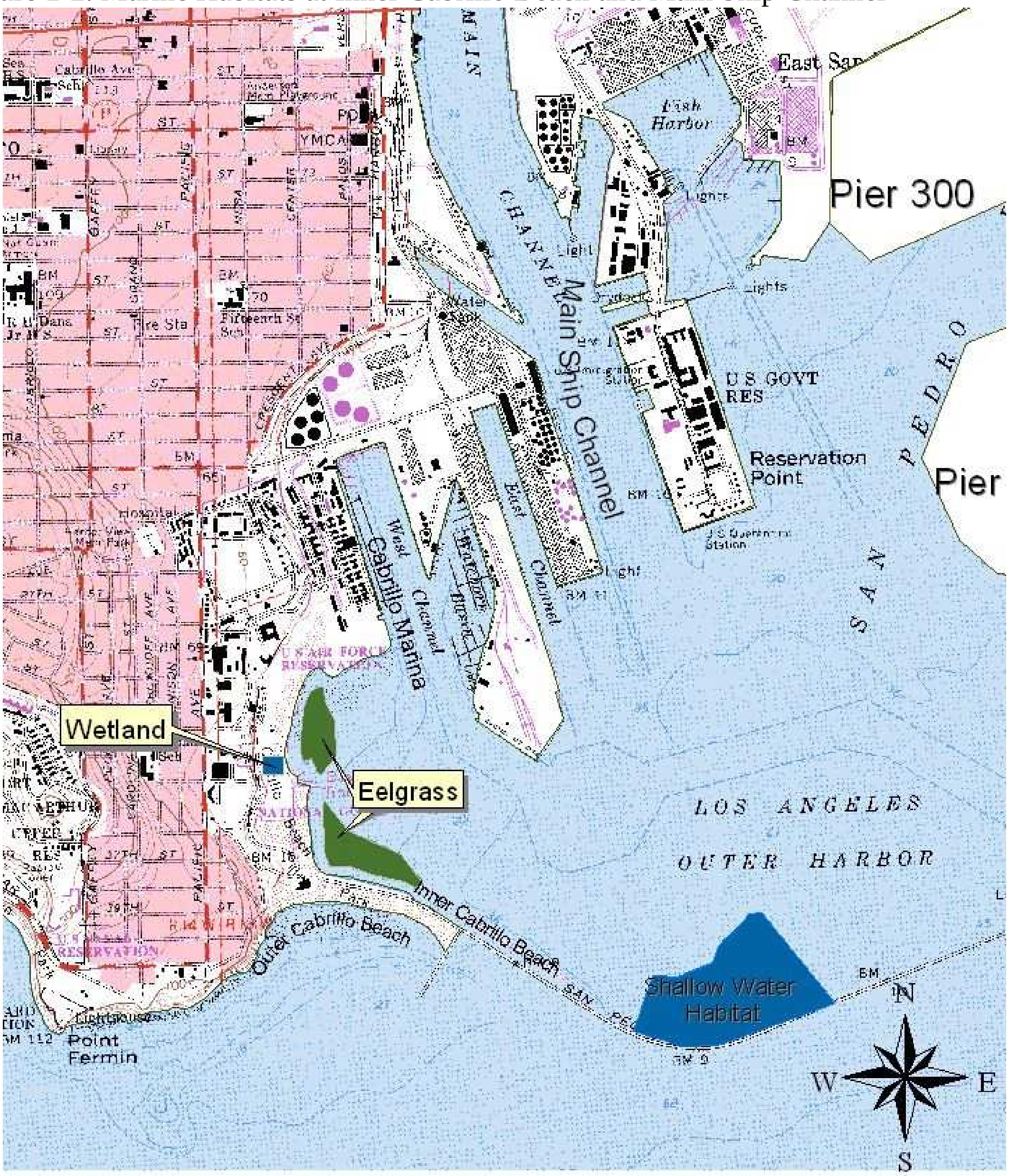
A small, man-made wetland (approx. 5 acres), “Salinas de San Pedro” which extends about 650 feet north along waterfront on northern Cabrillo Beach.

The Shallow Water Habitat, man-made during 1999-2000 as part of the Port of Los Angeles' Outer Harbor Channel Deepening and Pier 400 Construction Project. The Shallow Water Habitat is within outer harbor and supports some kelp habitat.

Extensive soft bottom, eelgrass beds which are between the constructed Shallow Water Habitat and the beach and in front of the Youth Watersports Facility.

The Main Ship Channel is deep bottom and maintained by dredging.

Figure 1-2. Marine Habitats at Inner Cabrillo Beach and Main Ship Channel



Birds: Over 100 species of birds occupy habitats in the Port of Los Angeles and Port of Long Beach, including four species that are listed as Threatened or Endangered by either the State or federal government (California Brown Pelican (*Pelicanus occidentalis californicus*), California least tern (*Sterna antillerum browni*), Western Snowy Plover (*Charadrius alexandrinus nivosus*) and Peregrine Falcon (*Falco pereginus anatum*). At least 18 bird species nest in the Port. Birds that use Inner Cabrillo Beach include gulls and pigeons as well as seasonal snowy plovers, Caspian terns, least terns, black skimmers, Forster's terns, brown pelicans, great blue herons, sanderlings, western and least sandpipers, willets western, Clark's, and eared grebes, cormorants, occasional loons and ducks (S. Vogel, Cabrillo Marine Aquarium, personal communication).

Fish: Over 70 species of fish have been noted in the Harbor. From 1993 to 2001 trawls for fish in the Los Angeles Harbor by the City of Los Angeles Environmental Monitoring Division, typically found 20 or 30 fish species, dominated by white croaker (*Genyonemus lineatus*), queenfish (*Seriphus politus*), California toungefish (*Symphurus atricauda*), Pacific sanddab (*Citharichthys stigmaeus*) (City of Los Angeles, 2002; 2001; 2000; 1999a; 1998; 1997; 1996). In beach seines on Inner Cabrillo Beach, commonly caught fish include serfperch, topsmelt, jacksmelt, pipefish and flatfish. In addition, there are grunion runs on the Inner and Outer Cabrillo Beaches March through July (S. Vogel, Cabrillo Marine Aquarium, personal communication).

Invertebrates: Over 400 species of invertebrates have been noted in the Harbor. From 1993 to 2001 trawls for invertebrates in the Los Angeles Harbor by the City of Los Angeles Environmental Monitoring Division, were dominated by blackspotted bay shrimp (*Crangdon nigromaculata*), american spider crab (*Pyromaia tuberculata*) and New Zealand cephlaspidian (*Philine auriformis*) (City of Los Angeles, 2002; 2001; 2000; 1999a; 1998; 1997; 1996).

Mammals: Los Angeles Harbor is used by California sea lions (*Zalophus californianus*) and occasionally harbor seals, elephant seals, dolphins and gray whale calves (S. Vogel, Cabrillo Marine Aquarium, personal communication).

1.3 Health Risks of Bacterial Impaired Waters for Water Contact Recreation

This section briefly discusses the health risks associated with swimming in marine water contaminated with human sewage and other sources of pathogens. The Regional Board intends to reduce these risks to public health at Cabrillo Beach and in the waters of Los Angeles Harbor through the development and implementation of this TMDL. Additionally, this section describes the applicable water quality standards and provides background on their development.

At stake is the both the health of the swimmers, fishermen and the many other people who visit the Cabrillo Beach and Los Angeles Harbor area every year and a degree of local economic value due to the associated health costs as well as possible loss of travel and tourism revenue.

Swimming in marine waters contaminated with human sewage has long been associated with adverse health effects (Favero, 1985). The most commonly observed health effect associated with recreational water use is gastroenteritis with symptoms including vomiting, fever, stomach pain and diarrhea. Other commonly reported health effects include eye, ear, skin infections, and respiratory disease.

Since the 1950s, numerous epidemiological studies have been conducted around the world to investigate the possible links between swimming in fecal-contaminated waters and health risks. Recently, the World Health Organization completed a comprehensive review of 22 published epidemiological studies, 16 of which were conducted in marine waters (Pruss, 1998). Fourteen of the 16 marine water studies found a significant association between bacteria indicator densities and the rate of certain symptoms or groups of symptoms. Most significant associations were found for gastrointestinal illnesses. However, as shown in several large-scale epidemiological studies of recreational waters, other health outcomes such as skin rashes, respiratory ailments, and eye and ear infections are associated with swimming in fecal-contaminated water. The Santa Monica Bay study, discussed below, found swimming in urban runoff-contaminated waters resulted in an increased risk of chills, ear discharge, vomiting, coughing with phlegm and significant respiratory diseases (fever and nasal congestion, fever and sore throat, or coughing with phlegm).

In fact, significant respiratory disease was the most common outcome to swimmers exposed to runoff polluted water in Santa Monica Bay (Haile, *et al*., 1996, 1999). Cheung, *et al*. (1990) found an increased risk of respiratory, skin rash and total illness associated with increased levels of bacteria indicator densities. Von Schirnding, *et al*. (1993) found increases in the risks of respiratory and skin symptoms with increasing bacteria indicator densities. Fattal, *et al*. (1986) found skin rash symptoms and "total sickness" (at least one health effect) outcomes increased with bacteria indicator densities. Corbett, *et al*. (1993) found a positive linear relationship between several symptoms including respiratory, ear, and eye symptoms and water pollution levels. These studies compel the conclusion that there is a causal relationship between illness and recreational water quality, as measured by bacteria indicator densities.

1.3.1 Santa Monica Bay Epidemiological Study

One of the studies reviewed in Pruss (1998) was the Santa Monica Bay Restoration Project epidemiological study conducted in 1995. This was the first epidemiological study to specifically evaluate the increased health risks to people who swam in marine waters contaminated by *urban runoff* (Haile, *et al.*, 1996, 1999). The results of the Santa Monica Bay study provided much of the basis for the current recreational water quality standards for marine waters in California (e.g., standards developed by the California Department of Health Services in response to Assembly Bill 411 (1997 Stats. 765)). The study collected health effects data from 11,793 individuals visiting three SMB beaches, including Santa Monica Beach, Will Rogers State Beach, and Surfrider Beach. Bacteria indicators measured in the study included total coliform, fecal coliform, *E. coli*, and enterococcus.

The epidemiological study was unique in several ways. First, the source of bacteria was not effluent from a sewage treatment plant, but instead urban runoff discharged from storm drains. Second, it examined both gastrointestinal illness and non-gastrointestinal illnesses including skin rashes and upper respiratory illnesses. Third, it analyzed the correlation between adverse health effects and the total-to-fecal coliform ratio in addition to previously studied bacterial indicators (i.e. total coliform, fecal coliform, *E. coli* and enterococcus). Finally, the study compared people swimming near a flowing storm drain to other people swimming 400 meters away from the drain. Positive associations were observed between adverse health effects and the distance an individual swam from the drain. The study found that 1 in 25 people swimming in front of a storm drain will get sick and that the likelihood of getting sick is twice as high for individuals swimming in front of a storm drain. The number of excess cases of illness attributable to swimming at the drain reached into the hundreds per 10,000 exposed participants, suggesting that significant numbers of swimmers in the water near flowing storm drains are subject to increased health risks. In addition, an increased health risk was associated with increasing densities of bacteria. Table 2-1 summarizes some of the health outcomes that were significantly associated with the four bacterial indicators at the proposed numeric targets in the TMDL.

Table 1-1. Health Risks at Proposed Numeric Targets (Haile et al., 1996, 1999; Haile and Witte, 1997)

Bacterial Indicator	Health Outcome	Attr. # (per 10,000)*
Enterococcus	Diarrhea with blood	27
	Gastroenteritis I**	130
Total coliform	Skin rash	165
Fecal/total ratio	Nausea	230
	Diarrhea	281
	Gastroenteritis II***	98
	Chills	117
Fecal coliform	Skin rash	74

Notes: *Attributable number. **Highly credible gastrointestinal illness I with vomiting, diarrhea and fever, or stomach pain and fever. ***Highly credible gastrointestinal illness II with vomiting and fever.

The health care costs are unknown. However, out-of-pocket health costs such as doctor visits and lost days at work due to poor bacteriological water quality ranged from $12 - $23 million per year in a study of Newport and Huntington Beaches (Dwight, 2001). In addition, there are likely to be economic losses due to bacterial contamination at beaches.

The travel and tourism industry in Los Angeles generates significant fees and taxes from travel related spending, including $751 million in state and local sales taxes and $212 million in federal taxes (Los Angeles Convention and Visitors Bureau, 2000). According to the Los Angeles Economic Development Corporation, spending by visitors to Los Angeles provides employment for approximately 280,000 area residents, making travel and tourism the fourth largest industry in Los Angeles County (Los Angeles Convention and Visitors Bureau, 2000).

1.4 STAKEHOLDER PARTICIPATION

Several stakeholder meetings were held as the TMDL was prepared.

1. A scoping meeting was held 29 September, 2003 with participants from Regional Board, the Southern California Coastal Water Research Project, and the City of Los Angeles including a representative from the Port of Los Angeles.

2. The first public meeting was held 2 December 2003. The Regional Board's Los Angles River watershed contacts, participants in the Dominguez Watershed Advisory Council and others were invited and approximately 30 people attended. The meeting included a presentation on the TMDL development process, including bacterial standards, review of available data, and review of previous work under the Clean Beaches Initiatives.

3. The second public meeting was held on 11 March 2004. Attendees of the previous meeting, participants in the Dominguez Watershed Advisory Council and others were invited and approximately 30 people attended. The meeting included a presentation on the current draft of the TMDL development and an invitation to comment on the draft then or by writing or phone before the next meeting.

4. A third public meeting was held on 22 April, 2004. Attendees of the previous meeting, participants in the Dominguez Watershed Advisory Council and others were invited and approximately 30 people attended. A summary of the comments and Regional Board staff response to the comments received from these meetings is provided in Appendix E.

1.4.1 Watershed Management Plan

The Dominguez Watershed Management Master Plan is in progress and has been published in draft by the Dominguez Watershed Advisory Council (DWAC) and their contractor MEC Analytical Systems, INC (Dominguez Watershed Advisory Committee, 2003).

The DWAC includes local government representatives, environmental groups, regulating agencies (including the Regional Board), members of business and industry, water and sewer providers and private citizens. The DWAC meets approximately once a month and the purpose of DWAC is to "Create and support implementation of a comprehensive watershed management master plan (WMMP) which will address current and potential problems and issues, potential solutions, prioritization of projects, funding opportunities, restoration/enhancement measures, and monitoring programs within the Dominguez Watershed."

2 PROBLEM IDENTIFICATION

2.1 WATER QUALITY IMPAIRMENTS

Inner Cabrillo Beach and the Los Angeles Harbor Main Ship Channel do not attain water quality standards due to high densities of bacteria that cause beach closures. Inner Cabrillo Beach and the Los Angeles Main Ship Channel are listed on the State of California Clean Water Act section 303(d) list of water quality limited segments (Los Angeles Regional Water Quality Control Board,. 2003a).

The 2002 Clean Water Act 303 (d) list of water quality limited segments lists Cabrillo Beach (Inner) LA Harbor Area for 'Beach Closures (Coliform)'. Cabrillo Beach (Inner) was also listed for 'Beach Closures (Coliform)' in the 1998 Clean Water Act 303 (d) list. Additionally, the beach is listed for 'DDT (fish consumption advisory for DDT)' and 'PCBs (fish consumption advisory for PCBs)'. Impairments due to DDT and PCBs will be addressed by a separate TMDL.

The 2002 State of California list of water quality limited segments lists Los Angeles Main Channel for 'Beach Closures'. LA Harbor Main Channel is also listed for 'Beach Closures' in 1998 Clean Water Act 303 (d) list. Additionally, the Los Angeles Main Channel is listed for 'Copper (tissue and Sediment)', 'DDT (tissue and sediment)', '(fish consumption advisory for DDT)', 'PAHs (tissue and sediment)', 'PCBs (fish consumption advisory for PCBs)', 'sediment toxicity' and 'Zinc (tissue and sediment)'.

Beach reports cards can be used as an illustration of the degree to which the Cabrillo Beach has been unable to attain standards. Both the County of Los Angeles, Department of Health Services and the environmental non-profit Heal the Bay calculate 'report cards' for California beaches. The County of Los Angeles, Department of Health Services "report card" generally gives Inner Cabrillo Beach a 30-day grade of "C" or "D" (County of Los Angeles, Department of Health Services, 2004). Using the same data, but different calculation methods, Heal the Bay Report Card generally gives Cabrillo Beach a "D" or "F" (Heal the Bay, 2003).

2.2 WATER QUALITY STANDARDS

Water quality standards for Cabrillo Beach and the Los Angeles Harbor Main Ship Channel are established in the Basin Plan. These water quality standards are made up of beneficial uses for surface and ground water, the numeric and narrative objectives necessary to support those uses, and the state's antidegradation policy.

2.2.1 Beneficial Uses

The Basin Plan designates beneficial uses for water bodies in the Los Angeles Region. These uses are recognized as existing (E), potential (P), or intermittent (I) uses. All beneficial uses, whether E, P or I, must be protected. Cabrillo Beach and the Los Angeles Harbor Main Ship Channel have several beneficial use designations including Navigation (NAV), Contact (REC-1) and Non-contact Recreation (REC-2), Commercial and Sport Fishing (COMM), Estuarine Habitat (EST), Marine Habitat (MAR), Wildlife Habitat (WILD), Rare, Threatened, or Endangered Species Habitat (RARE), Migration of Aquatic Organisms (MIGR), Shellfish Harvesting (SHELL) and may have wetlands (WET) associated with them (Table 2-1).

Table 2-1. Beneficial Uses of Cabrillo Beach and the Los Angeles Harbor Main Ship Channel

	Hydro. Unit #	NAV	IND	REC-1	REC-2	COM	MAR	WILD	RARE	MIGR	SHELL
Cabrillo Beach *(outer)*	**405.12**	**E**		**E**	**E**	**E**	**E**	**E**		**E**	**E**
Los Angeles-Long Beach Harbor Public Beach Areas *(Inner Cabrillo Beach)*	**405.12**	**E**		**E**	**E**	**E**	**E**	**E**	**E**	**P**	
Los Angeles Long Beach Harbor, All Other Inner Areas *(including Main Ship Channel)*	**405.12**	**E**	**E**	**P**	**E**	**E**	**E**		**E**	**E**	**P**

REC-1, REC-2 and SHELL beneficial uses are the focus of this TMDL as each require numeric bacterial objectives. REC-1 and REC-2 are designated as existing uses for Cabrillo Beach, the Los Angeles-Long Beach Harbor Public Beach Areas (to include inner Cabrillo Beach). The Los Angeles Long Beach Harbor, All Other Inner Areas (to include the Los Angeles Harbor Main Ship Channel) is designated REC-1 potential use REC-2 existing use and SHELL potential use.

The REC-1 beneficial use is defined in the Basin Plan as “Uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water-skiing, skin and scuba diving, surfing, white water activities, fishing, or use of natural hot springs”.

The REC-2 beneficial use is defined in the Basin Plan as: “Uses of water for recreational activities involving proximity to water, but not normally involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, picnicking, sunbathing, hiking, beachcombing, camping, boating, tidepool and marine life study, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities.”

The SHELL beneficial use is defined in the Basin Plan as “Uses of water that support habitats suitable for the collection of filter-feeding shellfish (e.g. clams, oysters, and mussels) for human consumption, commercial, or sports purposes.”

2.2.2 Water Quality Objectives

The Basin Plan contains bacteria water quality objectives to protect the REC-1, REC-2 and SHELL beneficial uses and the California Ocean Plan contains bacteria water quality objectives under “Water Contact Standards” and “Shellfish Harvesting Standards.”

On October 25, 2001, the Regional Board adopted a Basin Plan amendment updating the bacteria objectives for waters designated as REC-1 (Appendix B, Regional Board Resolution R01-018,). The State Board approved the Regional Board’s Basin Plan amendment on July 18, 2002 (Appendix C, State Board Resolution 2002-0142), the Office of Administrative Law approved it on September 19, 2002 (OAL File No. 02-0807-01-S), and the US EPA approved it on September 25, 2002. The revised objectives include geometric mean limits and single sample limits for four bacterial indicators, including total coliform, fecal coliform, the fecal-to-total coliform ratio, and enterococcus.

The revised Basin Plan objectives for marine waters designated for Water Contact Recreation (REC-1) are as follows:
1. Geometric Mean Limits
a. Total coliform density shall not exceed 1,000/100 ml.
b. Fecal coliform density shall not exceed 200/100 ml.
c. Enterococcus density shall not exceed 35/100 ml.

2. Single Sample Limits
a. Total coliform density shall not exceed 10,000/100 ml.
b. Fecal coliform density shall not exceed 400/100 ml.
c. Enterococcus density shall not exceed 104/100 ml.
d. Total coliform density shall not exceed 1,000/100 ml, if the ratio of fecal-to-total coliform exceeds 0.1.

The revised objectives are the same as those contained in state law (California Code of Regulations, Title 17, Section 7958, which implements Assembly Bill 411 (1997 States. 765)), which was passed, in large part, due to the Santa Monica Bay epidemiological study described above. Assembly Bill 411 resulted in changes to California Department of Health Services' regulations for public beaches and public water contact sports areas. These changes included (1) setting minimum protective bacteriological standards for waters adjacent to public beaches and public water contact sports areas based on four indicators (total coliform, fecal coliform, enterococcus, and the fecal-to-total coliform ratio) and (2) altering the requirements for monitoring, posting, and closing certain coastal beaches based on these four bacterial indicators. The revised objectives are also consistent with, but augment, current U.S. EPA guidance (1986), which recommends the use of enterococcus in marine water based on recent national epidemiological studies (Los Angeles Regional Water Quality Control Board, 2001; Cabelli, 1983).

These objectives are, in general, based on an acceptable health risk in marine recreational waters of 19 illnesses per 1,000 exposed individuals (US EPA, 1986). Based on the findings of the Santa Monica Bay epidemiological study described below, the health risk associated with these objectives ranges from 7 illnesses per 1,000 (fecal coliform objective) to 28 illnesses per 1,000 (fecal-to-total coliform ratio objective) (Table 1-1).

Protection of the REC-1 beneficial use will also result in protection of the REC-2 beneficial use as the water quality objective for fecal coliform to protect REC-2 is set at 10 times the REC-1 fecal coliform objective.

Additionally, there are objectives in the Basin Plan for areas designated for Shellfish harvesting (SHELL). "…the median total coliform concentration throughout the water column for any 30 day period shall not exceed 70/100 ml, nor shall more than ten percent of the samples collected during any 30-day period exceed 230/100 ml for a five-tube decimal dilution or 330/100 ml when a three tube decimal dilution is used."

The California Ocean Plan, Water Quality Objectives, Bacterial Characteristics, Standards for "Water –Contact" are: "within a zone bounded by the shoreline and a distance 1,000 feet from the shoreline or the depth contour – a density of total coliform less than 1,000 per 100 ml ; provided that not more than 20 percent of the samples at any sampling station, in any 30-day period, may exceed 1,000 per 100 and provided further that no single sample when verified by a repeat sample taken within 48 hours shall exceed 10,000 per 100 ml." However, new objectives are being drafted for the California

Ocean Plan which will be consistent with the Basin Plan recreational uses objectives also (Linda O'Connell, State Water Resources Control Board, personal communication).

For Shellfish Harvesting Standards, the California Ocean Plan is very similar to the Basin Plan, and states, "The median total coliform density shall not exceed 70 per 100 ml and not more than 10 percent of the samples shall exceed 230 per 100 ml."

2.2.3 Implementation Provisions for Bacterial Objectives

Implementation provisions for bacteria objectives were amended to the Basin Plan on December 12, 2002 and these procedures have been used in the recently adopted Santa Monica Bay Beaches Wet-Weather Bacteria TMDL and the Marina del Rey Harbor Mothers' Beach and Back Basins TMDL.

This Basin Plan Amendment states:

> "The single sample bacteriological objectives shall be strictly applied except when provided for in a Total Maximum Daily Load (TMDL). In all circumstances, including in the context of a TMDL, the geometric mean objectives shall be strictly applied. In the context of a TMDL, the Regional Board may implement the single sample objectives in fresh and marine waters by using a 'reference system/antidegradation approach' or 'natural sources exclusion' approach subject to the antidegradation policies as discussed below. A reference system is defined as an area and associated monitoring point that is not impacted by human activities that potentially affect bacteria densities in the receiving water body.
>
> These approaches recognize that there are natural sources of bacteria, which may cause or contribute to exceedances of the single sample objectives for bacterial indicators. They also acknowledge that it is not the intent of the Regional Board to require treatment or diversion of natural water bodies or to require treatment of natural sources of bacteria from undeveloped areas. Such requirements, if imposed by the Regional Board, could adversely affect valuable aquatic life and wildlife beneficial uses supported by natural water bodies in the Region.
>
> Under the reference system/antidegradation implementation procedure, a certain frequency of exceedance of the single sample objectives shall be permitted on the basis of the observed exceedance frequency in the selected reference system(s) or the targeted water body. The reference system/antidegradation approach ensures that bacteriological water quality is at least as good as that of a reference system and that no degradation of existing bacteriological water quality is permitted where existing bacteriological water quality is better than that of the selected reference system(s).

> Under the natural sources exclusion implementation procedure, after all anthropogenic sources of bacteria have been controlled such that they do not cause or contribute to an exceedance of the single sample objectives and natural sources have been identified and quantified, a certain frequency of exceedance of the single sample objectives shall be permitted based on the residual exceedance frequency in the specific water body. The residual exceedance frequency shall define the background level of exceedance due to natural sources. The 'natural sources exclusion approach subject to the antidegradation policies may be used if an appropriate reference system cannot be identified due to unique characteristics of the target water body. These approaches are consistent with the State Antidegradation Policy (State Board Resolution No. 68-16) and with federal antidegradation requirements (40 CFR 131.12)."

TMDLs and associated waste load allocations incorporated into permits, and load allocations for nonpoint sources are vehicles for implementation of standards. Therefore, the appropriateness of a reference system/antidegradation approach or a natural sources exclusion approach (subject to the antidegradation policies and the specific exceedance frequencies to be permitted under each) will be evaluated within the context of TMDL development for a specific water body. As proposed in this TMDL, waste load allocations will be incorporated into NPDES permits for municipal storm water (MS4), the Statewide Permit for Storm Water Discharges from the State of California Department of Transportation (CalTrans), non-storm water general NPDES permits, general industrial storm water permits, and general and individual permits. Load allocations for nonpoint sources will be implemented within the context of the TMDL. The reference system/antidegradation approach is the approach proposed in this TMDL. However, staff recognizes the most appropriate reference system may not be identified for Inner Cabrillo Beach and Main Ship Channel. The proposed TMDL schedule requires the Regional Board to re-consider this issue four years after the effective date of the TMDL. New information will be considered by staff when assessing whether a natural source exclusion approach, subject to antidegradation policies should be applied to the Inner Cabrillo Beach and the Main Ship Channel.

2.2.4 Antidegradation

Both the State of California and the Federal water quality regulations have antidegradation policies. The State policy is formally referred to as the "Statement of Policy with Respect to Maintaining High Quality Waters in California" (State Board Resolution No. 68-16). This policy restricts degradation of surface or ground waters and protects waterbodies where existing quality is higher than is necessary for the protection of beneficial uses. The Federal Antidegradation Policy (40 CFR 131.12) was developed under the Clean Water Act.

This TMDL complies with antidegradation policies by not setting any wasteload allocations, i.e. allowable exceedance days, above existing numbers of exceedance days.

2.3 SUMMARY OF AVAILABLE DATA

Most of the data which has been collected at Cabrillo Beach or in the Main Ship Channel has been collected by the City of Los Angeles to demonstrate compliance with the AB411 and Basin Plan REC-1 standards. Because the standards for the SHELL (shellfish) beneficial use and the ocean plan shellfish standards require the use of specific methods (i.e. multiple tube fermentation) which are not generally used to determine compliance with AB411 and Basin Plan REC-1 standards, we do not know how often shellfish standards are exceeded.

NPDES Permit for Terminal Island

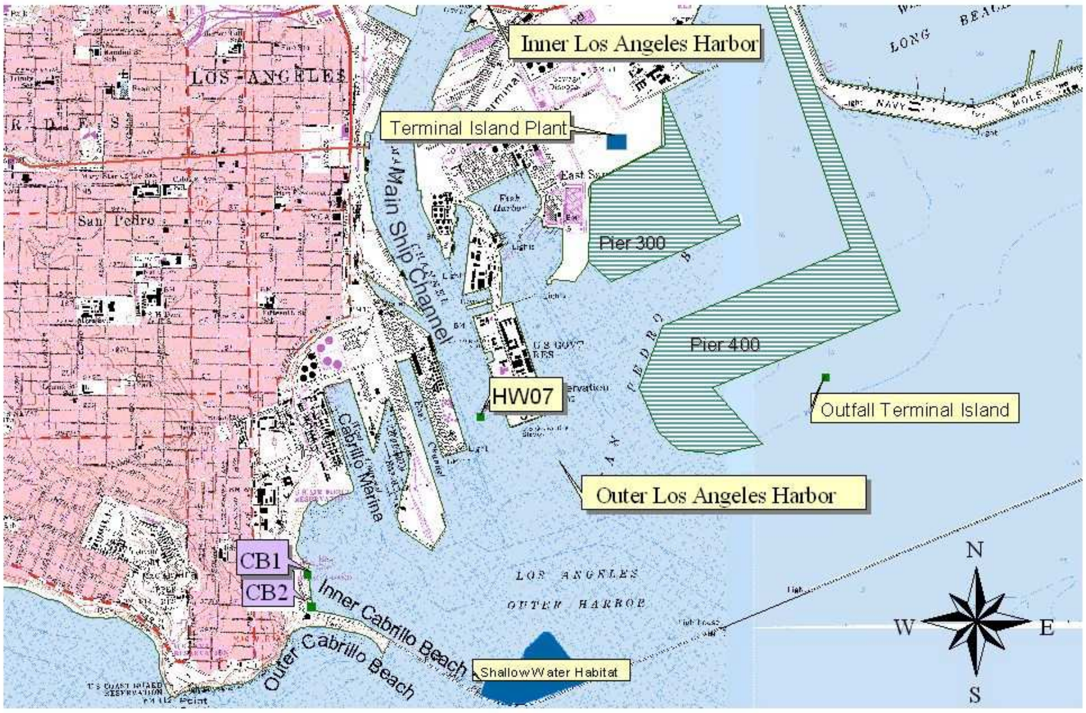
The primary source of historical bacterial density and water quality data for the Los Angles Harbor and Inner Cabrillo Beach and the Main Ship Channel is the data collected by the City of Los Angeles Sanitation Department, Environmental Monitoring Division as part of their comprehensive monitoring program required by their NPDES permit for the Terminal Island Treatment Plant which discharges to the Los Angeles Harbor (City of Los Angeles, 2002; 2001; 2000; 1999a; 1998; 1997; 1996).

Currently the City monitors water quality at 24 sites in the Harbor and two shoreline sites on Inner Cabrillo Beach under this permit. Since 1992, water quality monitoring has included depth, temperature, salinity, dissolved oxygen, transmissivity, pH and density. Since 1998, water quality measurements have also included percent saturation of dissolved oxygen, and chlorophyll.

Bacterial densities are measured at the two shoreline sites and 17 of the Harbor sites.

The shoreline sites on Cabrillo Beach are CB1, which is located in the wave wash on the north end of the swimming beach and CB2 which is in the wave wash at the south end of the swimming beach. At these sites total coliform, fecal coliform and enterococcus are measured daily. The site HW07 is located at the mouth of the Main Ship Channel and total coliform, fecal coliform and enterococcus are measured five times a month. Exceedances at these three sites was the primary reason for listing these areas on the Clean Water Act 303(d) list.

Figure 2-1 Monitoring Sites Cabrillo Beach and Los Angeles Harbor.



Inner Cabrillo Beach has a long history of frequent violations of bacterial water quality standards. The Main Ship Channel in the Harbor also has a long history of violations, but many fewer than the beach, itself. In the past five years, the number of bacterial exceedances at these Inner Cabrillo Beach sites have been high and at the CB2 site the number of exceedances have been exceedingly high. The following table (Table 2.2) shows the number of days during which there was an exceedance of one or more of the bacteria objectives. Data have been broken down into summer dry weather, winter dry weather, summer wet weather, and winter wet weather.

Exceedances occur most frequently in winter (wet season) than summer (dry season) but summer violations are also common. Even in summer dry weather, site CB2 had 39% of days exceeding single sample standards and 76% of days exceeding the geometric mean and single sample standards. Exceedances occur frequently during rainy days but also during dry weather.

Table 2-2. Percentage of Bacterial Density Exceedance Days at Cabrillo Beach (CB1 and CB2) and the Los Angeles Main Ship Channel (HW07).

Total coliform, fecal coliform and enterococcus bacterial densities were measured daily at the Cabrillo Beach sites and five times a month at the Ship Channel site. These three densities were compared to the seven single sample and geometric mean bacterial limits of the Basin Plan. Days included any day for which samples were taken or for which it was possible to calculate a geometric mean based on the previous 30 days. When, on any given day, any limit was exceeded, that day was counted as an exceedance day. Wet weather days were days of more than 0.1 inch of rain and the three days following rain days.

SUMMER *DRY* WEATHER				
	April 98 – October 02 (5 summers/35 months)		**April 01 – October 02 (2 summers/14 months)**	
site	**Days of any single sample exceedance (exceedance days/days)**	**Days of any single sample or geo mean exceedance (exceedance days/days)**	**Days of any single sample exceedance**	**Days of any single sample or geo mean exceedance**
CB1	**6.8% (66/962)**	**8% (78/963)**	**5% (20/419)**	**5% (20/19)**
CB2	**39% (377/965)**	**76% (735/966)**	**23% (98/420)**	**53% (224/420)**
HW07	**3.5% (6/172)**	**0.6% (6/1022)**	**2.7% (2/73)**	**0.4% (2/421)**

WINTER *DRY* WEATHER				
	November 98 – December 02 (4.5 winters/22 months)		November 01 – December 02 (1.5 winters/7 months)	
site	Days of any single sample exceedance (exceedance days/days)	Days of any single sample or geo mean exceedance (exceedance days/days)	Days of any single sample exceedance	Days of any single sample or geo mean exceedance
CB1	10% (44/443)	24% (109/449)	14% (24/166)	30% (49/166)
CB2	55% (244/443)	93% (419/449)	44% (72/165)	98% (161/165)
HW07	8% (7/83)	12% (57/491)	5.6% (1/18)	1% (1/111)

SUMMER *WET* WEATHER				
	April 98 – October 02 (5 summers/35 months)		April 01 – October 02 (2 summers/14 months)	
site	Days of any single sample exceedance (exceedance days/days)	Days of any single sample or geo mean exceedance (exceedance days/days)	Days of any single sample exceedance	Days of any single sample or geo mean exceedance
CB1	15% (8/52)	15% (8/52)	0% (0/5)	0% (0/5)
CB2	57% (28/49)	100% (49/49)	75% (6/8)	100% (8/8)
HW07	12% (1/8)	6.2% (3/48)	0% (0/2)	0% (0/7)

WINTER *WET* WEATHER				
	November 98 – December 02 (4.5 winters/22 months))		April 01 – October 02 (2 summers/14 months)	
site	Days of any single sample exceedance (exceedance	Days of any single sample or geo mean exceedance	Days of any single sample	Days of any single sample or geo mean

	days/days)	**(exceedance days/days)**	**exceedance**	**exceedance**
CB1	**25% (55/217)**	**52% (114/217)**	**26% (12/46)**	**33% (15/46)**
CB2	**78% (170/217)**	**100% (217/217)**	**68% (32/47)**	**100% (47/47)**
HW07	**22% (8/36)**	**7.8% (17/217)**	**0% (0/7)**	**0% (0/40)**

Most of the data which has been collected at Cabrillo Beach or in the Main Ship Channel has been collected by the City of Los Angeles to demonstrate compliance with the AB411 and Basin Plan REC-1 standards. Because the standards for the SHELL (shellfish) beneficial use and the ocean plan shellfish standards require the use of specific methods (i.e. multiple tube fermentation) which are not generally used to determine compliance with AB411 and Basin Plan REC-1 standards, we do not know how often shellfish standards are exceeded.

3 NUMERIC TARGETS

The TMDL will have a multi-part numeric target based on the bacteria objectives for marine waters designated for contact recreation (REC-1), specified in the Basin Plan amendment adopted by the Regional Board on October 25, 2001. As stated earlier, these objectives are the same as those specified in the California Code of Regulations, Title 17, Section 7958 "Bacteriological Standards" and consistent with those recommended in "Ambient Water Quality for Bacteria – 1986" (U.S. EPA, 1986). The objectives include four bacterial indicators: total coliform, fecal coliform, enterococcus, and the fecal-to-total coliform ratio. (Section 2.2.3.)

For the TMDL, the numeric targets will be the same as the recently adopted Basin Plan objectives. For Cabrillo Beach, the targets will apply at existing monitoring sites, with samples taken at ankle depth as they are now. For the Main Ship Channel the targets will also apply at existing or new monitoring sites with samples collected at the surface. These targets apply during both dry and wet weather, since there is water contact recreation throughout the year, including during wet weather.

To implement the recently adopted single sample bacteria objectives for waters designated REC-1 and to set allocations based on the single sample targets, the Regional Board has chosen to set an allowable number of exceedance days for each monitoring site. Staff proposes expressing the numeric target in the TMDL as 'allowable exceedance days' because bacterial density and the frequency of single sample exceedances are most relevant to public health. The US EPA allows states to select the most appropriate measure to express the TMDL; allowable exceedance days are considered an 'appropriate measure' consistent with the definition in 40 CFR 130.2(i). The number of allowable exceedance days is based on one of two criteria: (1) bacteriological water quality at any site is at least as good as at a designated reference site, and (2) there is no degradation of existing bacteriological water quality if historical water quality at a particular site is better than the designated reference site. Applying these two criteria allows the Regional Board to avoid imposing requirements to divert natural coastal creeks or treat natural sources of bacteria from undeveloped areas. This approach, including the allowable exceedance levels during summer dry-weather, winter dry-weather and wet-weather, is further explained in Section 6, Waste Load Allocations and Load Allocations.

3.1 Alternatives Considered

Three alternatives were considered for developing the appropriate numeric targets Inner Cabrillo Beach and Main Ship Channel bacteria: (1) Strictly application of the water quality objectives as listed in the Basin Plan with no exceedance, (2) Natural sources exclusion, and (3) Reference system/antidegradation approach with specific exceedance day frequencies. The criteria used for selecting recommended alternative include:

- consistency with State and Federal water quality laws and policies;
- level of beneficial use protection;
- consistency with current science regarding water quality necessary to protect the beneficial uses; and
- applicability to Inner Cabrillo Beach and Main Ship Channel.

3.2 Recommended Alternative

These alternatives recognize that there are natural sources of bacteria, which may cause or contribute to exceedances of the single sample objectives for bacterial indicators. They also acknowledge that it is not the intent of the Regional Board to require treatment or diversion of natural water bodies or to require treatment of natural sources of bacteria from undeveloped areas.

For this TMDL, alternative (3) is the recommended alternative since this alternative allows the Regional Board to avoid imposing requirements to divert natural coastal creeks or treat natural sources of bacteria from undeveloped areas. This approach, including the allowable exceedance levels during summer dry-weather, winter dry-weather and wet-weather, is further explained in Section 6, Waste Load Allocations and Load Allocations. The recommended numeric targets will be assessed as allowable number of single sample exceedance days for each site because the frequency of single sample exceedances are most relevant to public health. The US EPA allows states to select the most appropriate measure to express the TMDL; allowable exceedance days are considered an 'appropriate measure' consistent with the definition in 40 CFR 130.2(i). The number of allowable exceedance days is based on one of two criteria: (1) bacteriological water quality at any site is at least as good as at a designated reference site, and (2) there is no degradation of existing bacteriological water quality if historical water quality at a particular site is better than the designated reference site. For Cabrillo Beach, the targets will apply at existing monitoring sites, with samples taken at ankle depth as they are now. For the Main Ship Channel, the targets will also apply at existing or new monitoring sites with samples collected at the surface. These targets apply during both dry and wet weather, since there is water contact recreation throughout the year, including during wet weather.

Under alternative (1), strict application of the water quality objectives as listed in the Basin Plan with no exceedance, the targets could require treatment or diversion of natural water bodies or to require treatment of natural sources of bacteria from undeveloped areas and which would adversely affect valuable aquatic life and wildlife beneficial uses.

Under alternative (2), natural sources exclusion, after all anthropogenic sources of bacteria have been controlled such that they do not cause or contribute to an exceedance of the single sample objectives and natural sources have been identified and quantified, a certain frequency of exceedance of these objectives would be permitted based on the residual frequency of exceedance. The residual exceedance frequency would define the background level of exceedance due to natural sources. No reference beach can be perfectly appropriate (i.e. exactly like the TMDL beach in every way except undeveloped). Natural sources exclusion avoids any difficulties with the reference beach approach due to this lack of similarity. However, to completely remove all anthropogenic sources from an urban, heavily used, beach may be vastly impracticable.

4 SOURCE ASSESSMENT

This section discusses potential sources of bacterial contamination to Inner Cabrillo Beach and the Main Ship Channel. The Source Assessment is based on monitoring data and special studies by the City of Los Angeles, as well as recent bacterial surveys by the Regional Board to characterize the Main Ship Channel.

4.1 POINT SOURCES

4.1.1 Terminal Island

The Terminal Island Treatment Plant of the City of Los Angeles serves the Harbor area and has been in operation since the early 1930's. The plant was upgraded to full secondary treatment in 1977 and to secondary filtration treatment in 1996 (City of Los Angles, 2002).

The plant discharges to the Los Angeles Harbor under a National Pollutant Discharge Elimination System (NPDES) permit, No. CA 0053856. This permit requires extensive monitoring of effluent quality and also bacterial densities, water quality, benthic sediments and macrofauna, demersal fish and invertebrates and priority pollutant tissue concentrations of white croaker throughout the Harbor to determine impacts, if any, from the discharged effluent from the Terminal Island Plant. The principle monitoring at

Cabrillo Beach (sites CB1 and CB2) and in the Harbor (site HW07) is conducted by the City in compliance with this permit.

The plant has a dry weather design capacity of 30 million gallons per day. In the year 2000, Terminal Island Treatment Plant discharged an average of 15.7 million gallons per day. Approximately 70% of the wastewater is from industrial and commercial sources and the remaining 30% is domestic.

The outfall from Terminal Island Treatment Plant is located in the Los Angeles Outer Harbor to the south and west of Pier 400 (Figure 2.1).

The water quality monitoring in the Harbor includes 12 stations in the vicinity of the outfall and data from these sites are used to locate the wastewater field. Typically, the wastewater field is detected by salinity differences between the saline Harbor waters and the fresher discharge. The wastewater field is generally small, detectable at only a few of the stations within 0.5 km of the outfall. Fecal coliform are often found within the detected wastewater field, but counts are generally low. For example, in 2000 fecal coliform in the wastewater field was below 35/100ml. The estimated dilution of the wastewater field is typically greater than 125:1 (City of Los Angeles, 2002).

While the fecal coliform counts in the wastewater field indicate a contribution of bacteria to the Harbor by the Treatment Plant, the wastewater field is sufficiently dilute and the bacterial densities are so much lower in the Harbor than the high bacterial densities and exceedences at the sites at Cabrillo Beach and in the Main Ship Channel that it appears that the Treatment Plant is not a significant source of bacteria to the Beach or to the Ship Channel.

4.1.2 Other Point Source Discharges.

As of March 2004, there are 15 active, individual NPDES permits for discharges to the Inner or Outer Los Angeles Harbor including the Terminal Island Treatment Plant.

Table 4-1 Active, Individual NPDES Permits discharging to the Los Angeles Harbor

Inner Harbor				
	Permit No.	**Discharger**	**Facility**	**discharge to:**
	97-079	**Al Larson Boat Shop**	**Al Larson Boat Shop**	**Inner Harbor**
	00-086	**Shell Oil Products**	**Mormon Island Marine terminal**	**LA Inner Harbor**
	R4-2003-0028	**City of Los Angeles, DWP**	**Harbor Steam Plant**	**LA Inner Harbor**
	R4-2003-0117	**United States Borax and Chem Corp.**	**Wilmington Plant**	**LA Inner Harbor**

	R4-2003-0150	**City of Los Angeles, DWP**	**Harbor Steam Plant, Marine Tank Farm**	**LA Inner Harbor**
Outer Harbor				
	01-152	**Southern Ca. Marine Institute**	**Southern Ca. Marine Institute**	**Los Angeles Harbor**
	93-014	**City of Los Angeles, Bureau of Sanitation**	**Terminal Island Wastewater Treatment Plant**	**Los Angeles Outer Harbor**
	97-060	**ExxonMobil Oil Corp**	**Southwestern Terminal Area I**	**Los Angeles Harbor**
	R4-2002-0029	**Ultramar Inc.**	**Marine Terminal, Berth 164**	**Los Angeles Harbor**
	R4-2002-0079	**VOPAK Terminal Los Angeles Inc.**	**Petroleum and Chemical Terminal**	**Los Angeles Harbor**
	R4-2003-0022	**Shore Terminal LLC.**	**Wilmington Marine Terminal**	**Los Angeles Harbor**
	R4-2003-0023	**Southwest Marine, Inc.**	**Southwest Marine Inc.**	**Los Angeles Harbor**
	R4-2003-0053	**Kinder Morgan**	**San Pedro Marine Terminal**	**Los Angeles Harbor**
	R4-2003-0073	**Kinder Morgan**	**Los Angeles Harbor Terminal**	**Los Angeles Harbor**
	R4-2003-0101	**City of Los Angeles, DWP**	**Harbor Generating Station**	**Los Angeles Harbor**

As of March 2004, there are 15 active, general NPDES permits for discharges to the Inner or Outer Los Angeles Harbor.

Table 4-2 Active, General NPDES Permits discharging to the Los Angeles Harbor

Inner Harbor				
	Permit No.	**Discharger**	**Facility**	**discharge to:**
	97-045 **6089**	**LA County Dept of Public Works**	**Dominguez Gap Barrier Project**	**Dominguez Channel and Inner Harbor**
	R4-2002-0125 **7565**	**Defense Fuel Support Point**	**DFSP San Pedro-Pump House Area**	**LA Inner Harbor**
Outer Harbor				

	97-043 **8404**	**Charles King Company**	**LA Harbor Siphon Crossing**	**Los Angeles Harbor**
	97-043 **7929**	**City of Los Angeles, DWP**	**Los Angeles Harbor WRP**	**Los Angeles Harbor**
	97-043 **8126**	**Pacific Terminals LLC**	**Systems Wide Pipelines**	**Long Beach Harbor and Los Angeles Harbor**
	97-047 **7332**	**Kinder Morgan (Former GATX)**	**Berth 118-119**	**Los Angeles Harbor**
	97-047 **8611**	**ExxonMobil Oil Corp**	**LA Channel Crossing Pipeline**	**Long Beach Harbor and Los Angeles Harbor**
	97-047 **8045**	**City of Los Angeles, DWP**	**Los Angles harbor WRP**	**Los Angeles Harbor**
	97-047 **8467**	**Shell Oil Products, US**	**Shell Mormon Island Marine Terminal**	**Los Angeles Harbor**
	97-047 **8465**	**Shell Oil Products, US**	**Shell Signal Hill Terminal**	**Los Angeles and Long Beach Outer Harbor**
	97-047 **8095**	**Pacific Terminals LLC**	**Systems Wide Pipelines**	**Long Beach Harbor and Los Angeles Harbor**
	R4-2002-0125 **8322**	**ConocoPhillips Company**	**76 Station #3768**	**Los Angeles Harbor**
	R4-2003-0111 **8616**	**Defense Energy Support**	**Berth 100 Backland Dev. Proj.**	**Los Angeles Harbor**
	R4-2003-0111 **8363**	**Marina Two Holding Partnership**	**Esprit, Marina Parcel 12**	**Los Angeles Harbor**

Discharges from individual NPDES permits and general NPDES permits are not expected to be a significant source of bacteria.

4.2 STORMWATER

4.2.1 Upstream Stormwater Contributions to Harbor Waters

MEC Analytical Systems (MEC) conducted a survey of bacterial densities along the main channel and tributaries of the Dominguez Channel for the Regional Board in June 2002 and October 2003 (Los Angeles Regional Water Quality Board, 2002c; 2003c). Total coliform, fecal coliform, *E. coli*, and enterococcus densities were measured at 51 sites in the Channel covering a distance of 15 miles from where the channel first daylights to the estuarine portion of the channel where it enters the Port of Los Angeles.

During both sampling events, more than 50% of the open channel samples taken exceeded established fresh or salt water objectives (in freshwater, fecal coliform density not greater than 400/100ml and *E. coli* density not greater than 235/100 ml). Water samples from the furthest downstream, estuarine, sites were much less likely to exceed limits probably due to coliform death caused by environmental stresses and mixing with cleaner harbor waters. In lateral waterways or outfalls to the channel, limits were more frequently exceeded.

While bacterial levels in 2003 samples were somewhat less than 2002 samples, since there were only these two single-event samplings, conclusions cannot be drawn about changes in bacterial densities in time. However, for both years similar patterns were seen in the coliform parameters (total, fecal and *E. coli*): coliform densities where the channel first daylights were very high, lateral and outfall water samples had higher coliform densities than open channel samples and the most downstream water samples had lower coliform densities. For enterococcus bacterial densities, these patterns were also seen in both years but were less discernable.

4.2.2 Storm Drains into the Inner Harbor.

MEC Analytical Systems (MEC) conducted a survey of bacterial densities in the Inner Los Angeles Harbor for the Regional Board and the Southern California Coastal Watershed Research Project in March 2004 (Los Angeles Regional Water Quality Board, 2004). Water samples from 28 sites were collected during three separate sampling events, 2 days during dry weather and one during wet weather. Most sites were paired to include a stormdrain or outlet site with a site 25 yards from that drainage. Several samples were taken in the open Harbor waters, i.e. not necessarily under the influence of a particular storm drain.

The same bacterial parameters were measured as in the Dominguez Channel sampling described above, total coliform, fecal coliform, *E. coli* and enterococcus. The data for all of these parameters showed a similar pattern: during dry weather some samples taken directly from storm drains were above samples and fewer of the samples taken from sites in open water near the storm drains were above standards; but during wet weather, most samples taken from storm drains and sample taken from sites in the open water were above standards. For *E. coli* there is no marine standard but a similar pattern as others, low bacterial density values during dry weather, higher values during wet weather, was seen.

Several storm drain sites were markedly higher than other sites including sites in Slip 5, Southwest Slip, and SP Slip. The three open Harbor sites were sampled in dry weather and bacterial density values were not above standards; the one open Harbor waters sample taken during wet weather (near the City of Los Angeles monitoring site, HW07) was above standards for total coliform and enterococcus.

4.2.3 Storm drains on or near Cabrillo Beach

There are five storm drain outfalls that discharge into Los Angeles Harbor in the vicinity of Cabrillo Beach. Of these, only one, a 24 inch outfall, directly discharges at Cabrillo swimming Beach. Much more runoff discharges through three outfalls adjacent to or directly into the small man-made wetland on northern Cabrillo Beach just to the north of the boat launch. These outfalls receive runoff from the Cabrillo Beach Parking lot, Fort MacArthur, Shoshonean Road and Inner Cabrillo Beach area. A final outfall receives runoff from Via Cabrillo Marina and the parking lot south of the San Pedro Hilton and discharges to the Cabrillo Marina breakwater. Additionally, there is a 24 inch storm drain buried in the sand (near the 24 inch beach storm drain) which may contribute storm water to the beach.

Storm Drain Investigation, Port of Los Angeles

As part of a SWRCB Clean Beaches Initiative grant to improve water quality on Cabrillo Beach, the Port of Los Angeles conducted an investigation of bacterial contamination of Cabrillo Beach interstitial waters in 2003 which demonstrated that the 24 inch outfall directly to the swimming Beach is contributing bacteria to the Beach (City of Los Angeles, 2003a). Contaminated interstitial waters indicate the presence of broken sanitary or storm drains discharging into the sand. Samples were taken in several transects along the beach and bacterial densities of total coliform, E. coli, and enterococcus were measured. Samples were taken of surface sand interstitial water, six inches below the surface and twelve inches below the surface.

Bacteria were undetectable in most interstitial samples, however, there were some samples with detectable levels of bacteria and a few where the levels of bacteria exceeded Basin Plan water quality standards.

Of the samples which exceeded water quality standards, two out of three surface water samples, the single 6 inch depth, and the single 12 inch depth sample were in the vicinity outfall of the 24 inch storm drain which drains to the southern part of Inner Cabrillo Beach.

The Port of Los Angeles which conducted the study is currently making specific plans to repair and reroute the 24 inch drain.

4.3 NONPOINT SOURCES

4.3.1 Water Quality and Distance from Tideline.
To investigate the contribution of Beach sources, the City of Los Angeles' Environmental Monitoring Division (EMD) conducted a study of water quality vs. depth and distance from tide line (City of Los Angeles, 1999b). During the week of 6 October, 1999, EMD collected water samples for bacterial densities of total coliform, E. coli and enterococcus from surface water which was ankle, knee and chest depth.

For all three parameters, total coliform, *E. coli* and enterococcus, the highest values were from the samples which were collected from water which was at ankle depth and then the knee depth and then chest; that is, over this short distance, values decreased with distance from shore. All samples from water which was knee and chest depth met the Basin Plan water quality standards. However, the ankle depth samples exceeded enterococcus standards and one of the four *E. coli* densities were above fecal coliform standards. These results support the contention that high bacterial densities may be largely from the beach, itself.

In addition, as part of their Clean Beaches Initiative grant for Cabrillo Beach, the Port of Los Angeles compared Outer Harbor Waters with samples taken very close to the Beach. These studies show that the bacterial contamination at Inner Cabrillo Beach is limited to the shallow water at ankle depth. Samples from knee and waist depth indicate that bacterial levels are within water quality standards.

4.3.2 Cabrillo Beach Bird Exclusion Study

On 7 July, 2000 City of Los Angeles directed the Environmental Affairs Division, Recreation and Parks, Harbor Department and EMD to conduct a study to determine if bacterial contamination at the beach is caused by birds and if the contamination could be reduced (Dalkey and Bahariance, 2003).

A bird exclusion structure was placed on the beach in September of 2000 consisting of monofilament line suspended from poles in the tidal reach (Figure 2.1).

To study the effectiveness of the bird exclusion structure in reducing bacterial indicator densities, the City added an additional daily bacterial monitoring site for one year outside the bird exclusion device, designated CBE, so that comparisons could be made to the established site, CB2, which was under the device. Bird counts at both sites were also made.

The bird exclusion structure was effective in significantly reducing the birds on the beach within the bird exclusion structure by 95%.

Exceedance of Basin Plan standards occurred less frequently after the installation of the bird exclusion structure (Table 4.3). Bacterial levels were reduced up to 60% at CB2 (under the structure) compared to CBE (outside the structure). However, bird counts and bacterial levels varied considerably and a correlation between bird counts and bacterial levels could not be made.

Table 4-3. Frequency of Bacterial Concentrations Exceeding Basin Plan Bacterial Water Standards Prior to During and After Construction of the Bird Exclusion Structure for June – December 1999 and July – December 2001.

Basin Plan Standard (per 100ml)		1999	2001	
		CB2	CB2	CBE
Total coliform	10,000	2.8%	0.6%	2.5%
Fecal coliform	400	32.2%	10.4%	27.6%
Enterococcus	104	51.7%	23.7%	43.1%
Fecal:total	0.1, total > 1,000	18.8%	3.9%	37.0%

4.3.3 OTHER

Other nonpoint sources of bacterial contamination at Cabrillo Beach include swimmer washoff, trash on the Beach washing into the water, local feral cat fecal contributions, sidewalk washdowns, landscape irrigation, marina activities such as waste disposal from boats, boat deck and slip washing, and natural sources from wildlife other than birds. The bacteria loads associated with these nonpoint sources are unknown.

Restrooms are washed down into the sanitary sewer but the sidewalk and boat launch are also washed down which may runoff into the water (City of Los Angeles, 2002). Additional trashcans and signage about trashcan usage and not feeding birds were added in 2000, but overflowing trashcans continues to be a problem (S. Vogel, Cabrillo Marine Aquarium, personal communication). Currently, the last time in the day the trash cans are emptied is before 2:30 pm, the end of the maintenance crew day.

The feral cat population is fed by local residents and is estimated to be 30 to 50 individuals (M. Taggart, Heal the Bay, personal communication). Staff from the Cabrillo Marine Aquarium are attempting to work with the residents to lessen the impact of the cats on the Beach.

5 LINKAGE ANALYSIS

Regional Board staff reviewed four studies sufficient to provide an analysis of the linkage between bacterial sources and water quality at Inner Cabrillo Beach. These four reports include field monitoring data, numerical analysis and modeling, and dye studies.

The reports include:

1. City of Los Angeles, 2003b. Compilation of Pertinent Data- Inner Cabrillo Beach Water Quality Improvement Project, Submittal to City of Los Angeles, Harbor Department by Kinnetic Laboratories Incorporated, March, 2003.

2. U.S. Army Corps of Engineers, 2002. Water Quality and Hydrodynamic Analysis of the Cabrillo Shallow Water Habitat, U.S. Army Corps of Engineer, Engineer Research and Development Center, Water ways Experiment Station for the U.S. Army Engineer District, Los Angeles, July, 2002.

3. City of Los Angeles, 2003c. Inner Cabrillo Beach Pre-Construction Monitoring, Draft Data Report, Submittal to The Port of Los Angeles and the U.S. Army Corps of Engineers by Evans-Hamilton, Inc, February, 2003.

4. U.S. Army Corps of Engineers, 2004. Inner Cabrillo Beach Circulation Study, Draft Report, Submittal to U.S. Army Engineer District, Los Angeles and U.S. Army Engineer Research and Development Center, Coastal and Hydraulics Laboratory, February, 2004.

In the "Compilation of Pertinent Data- Inner Cabrillo Beach Water Quality Improvement Project" Report, water quality data from historical and present monitoring and shoreline studies were analyzed and discussed. Much of the data reviewed in this report is also reviewed in this Staff Report. Several probable local sources of contamination, including the sanitary collecting system, storm drainage system, and local facilities including human use, dog use, and feral cats, were reviewed. The avian bacterial sources and bird exclusion studies were also reviewed in this report. From this study, the following major conclusions were drawn by the Port of Los Angeles:

> 1. Comparison of data from the Inner Cabrillo Beach with offshore water sites indicates that the bacterial impairment at Inner Cabrillo Beach is from a local source, and is not introduced to the beach by Harbor waters.
>
> 2. Results of water samples showed the highest values for total coliform, *E. coli*, and enterococcus in samples collected at ankle depth. All knee and chest level counts were below water quality standards.
>
> 3. The large population of birds was identified as the most significant source of bacterial contamination at Inner Cabrillo Beach. In order to reduce the population and use of the beach by birds, a bird exclusion structure was constructed in September of 2000. The frequency of exceedances of the Water Quality Standards decreased by 65% following the installation of the bird exclusion structure. However, the bacterial contamination of the water at Inner Cabrillo Beach was not fully mitigated by the presence of the bird exclusion structure.

In the "Water Quality and Hydrodynamic Analysis of the Cabrillo Shallow Water Habitat" report, the focus of the study was to determine what impact, if any, the construction of the Cabrillo Beach Shallow Water Habitat (CSWH) has had, and its proposed expansion will have, on water circulation and water quality at Inner Cabrillo Beach. Based on the model results, the following conclusions were reached:

1. There are only minor differences between water circulation and water quality results for the base configuration of the Harbor and the conditions after deepening of outer Harbor, constructing Pier 400, and building the Shallow Water Habitat (Pier 400 Project). This indicates no significant impact on waters within 300 to 500 feet of Inner Cabrillo Beach.

2. In addition, there are only minor differences predicted in water circulation and water quality for the proposed inner Harbor deepening and Shallow Water Habitat expansion, indicating that expanding the habitat will have no significant impact on water circulation and water quality in western San Pedro Bay.

3. An opening in the breakwater could have some positive impact on water circulation and water quality in western Harbor. The improvement could be attributed to the mixing of open ocean and Harbor waters. However, the opening would have little impact on water immediately adjacent to the beach. An opening in the breakwater would also raise other issues, not studied, including breakwater stability, erosion of the Harbor bottom (including the Shallow Water Habitat), harbor resonance, beach stability and wave strength at the beach.

In the “Inner Cabrillo Beach Pre-Construction Monitoring” report, the study was designed to investigate the primary contaminant source in the shallow waters of Inner Cabrillo Beach from a water circulation perspective. The dye study was recommended to examine currents in the shallow, near-shore region of the beach and to assist in mapping and understanding the spatial and temporal circulation of the water mass over a complete 25-hour tidal cycle. The conclusions drawn from this study are:

1. The dye study results showed that the circulation was found to be governed by the tidal and wind driven currents. The measured currents throughout the study were very weak, with a maximum of 12 cm/sec. As a result, the pollutant sources from beach area are not well carried away by the currents to the offshore waters, which means the contamination is, to a large extent, constrained on the shallow waters of Inner Cabrillo Beach.

2. During periods of little or no wind, the circulation is tidally controlled, vertically similar. During periods of strong winds, which occurred between 8:00 am –10:00 pm each day, the wind dominated the influence of the tides on the surface layers, pushing the surface layer offshore, regardless of the stage of the tide cycle. This create a two-layer circulation, with bottom water directed toward the shore, upwelling and flushing surface waters offshore.

In the “Inner Cabrillo Beach Circulation Study” report, the study was designed to see how widespread, consistent, and beneficial the two-layer flow is in reducing bacterial densities at Inner Cabrillo Beach. Daily removal of bacteria from near-shore waters by a wind-induced two layer flow, with the surface flow headed offshore, have the potential to significantly reduce the bacteria contamination during the period of the winds. Since water samples for measurements of the bacteria concentrations are normally acquired in the early morning prior to the start of the daily winds, it was hypothesized that when the daily winds became strong in the late morning and initiated a two-layer circulation with the surface waters heads offshore toward the shipping channel, that this two-layer circulation might extend in toward the beach, and act as a cleaning mechanism. The results of the study showed that:

1. The wind speeds and directions observed during September 2002 are consistent and typical of the winds observed during this study from late July through early October.

2. These winds consistently generate a two-layer flow in the region, thus this two-layer flow is typically generated every day, regardless of the tide stage, and reaches sufficiently close to shore that it would provide a reliable mechanism for both renewal of water in the Cabrillo Beach, and carrying surface borne contaminants out of the bay and away from the swimming beach.

The study combines near-shore current measurements and bacterial measurements to confirm that the bacteria contamination becomes reduced when the wind-generated two-layer flow becomes established.

A Linkage Analysis of the Main Ship Channel shows an association between the concentrations of bacteria in the storm drain effluent in the Inner Harbor and the concentrations of bacteria in the open waters of the Inner Harbor including the Main Ship Channel (Los Angeles Regional Water Quality Board, 2004). Because the Dominguez Channel data shows few exceedances at the southernmost end of the Dominguez Channel, where it enters the Inner Harbor (Los Angeles Regional Water Quality Board, 2003c; 2002a), it appears less likely that the discharge from the Dominguez Channel, itself, is responsible for exceedances in the Main Ship Channel.

6 ALLOCATIONS

6.1 INTRODUCTION

Waste Load Allocations (WLA) are allocations of bacterial loads to point sources and Load Allocations (LA) are allocations of bacterial loads to non-point sources. WLAs and LAs are expressed as the number of daily or weekly sample days that may exceed the single sample targets identified in Section 3 at appropriate monitoring sites. WLAs and LAs are expressed as allowable exceedance days because the bacterial density and frequency of single sample exceedances are the most relevant to public health protection.

Allowable exceedance days are 'appropriate measures' consistent with the definition in 40 CFR 130.2(i).

For each monitoring site, allowable exceedance days are set on an annual basis as well as for three other time periods. These three periods are (1) summer dry-weather (April 1 to October 31), (2) winter dry-weather (November 1 to March 31), and (3) wet-weather (defined as days of 0.1 inch of rain or more plus three days following the rain event).

6.1.1 Main Ship Channel

The Regional Board study of the Main Ship Channel showed that the major source of bacterial contamination was discharges from storm drains which are regulated under the MS4 permit. As discussed in Section 4.1.2, discharges from individual and general NPDES permits, general industrial storm water permits and general construction storm water permits are not expected to be a significant source of bacteria. Therefore, the WLAs for these discharges are zero (0) days of allowable exceedance for all three time periods for the single sample limits and the rolling 30-day geometric mean. Any future enrollees under an individual or general NPDES permit, general industrial storm water permit or general construction storm water permit to the Los Angeles Harbor will also be subject to a WLA of zero days of allowable exceedances.

Consequently, the proposed WLAs for summer dry-weather are zero (0) days of allowable exceedances (Table 6-3) and the proposed waste load allocation for the rolling 30-day geometric mean for any of the three periods is zero (0) days of allowable exceedances. The winter dry WLAs are proposed in Table 6-4. The Main Ship Channel is already meeting the wet weather exceedances which are proposed in Table 6-5.

Because nonpoint source loads were found to be minor in the MSC, Load allocations (LAs) of zero (0) days of allowable exceedances for nonpoint sources are proposed for the MSC in this TMDL for each time period. The load allocation for the rolling 30-day geometric mean for nonpoint sources is also zero (0) days of allowable exceedances. If a nonpoint source is directly impacting bacteriological water quality and causing an exceedance of the numeric targets, the permittee(s) under the Municipal Storm Water NPDES Permits are not responsible through these permits.

6.1.2 Inner Cabrillo Beach

The assignment of WLAs for the swimming portion of Inner Cabrillo Beach is based on an assumption that storm drains and sanitary sewers will be rehabilitated so that they do not discharge into this area. Consequently, the WLA for summer, dry-weather, winter dry-weather and wet-weather, single sample bacterial densities in Inner Cabrillo Beach are zero (0) days of allowable exceedances.[1] The load allocation for the rolling 30-day

[1] In order to fully protect public health, no exceedances are permitted at any monitoring location during summer dry-weather (April 1 to October 31). In addition to being consistent with the two criteria, waste load allocations of zero (0) days of allowable exceedances are further supported by the fact that the California Department of Health Services has established minimum protective bacteriological standards –

geometric mean during any time period or monitoring site in the Inner Harbor is zero (0) days of allowable exceedances.

All proposed LAs for summer, dry-weather, single sample bacterial densities at the ICB swimming beach are zero (0) days of allowable exceedances (Table 6-3). The proposed LAs for single sample winter dry-weather and wet-weather for the monitoring locations CB1 and CB2 are as shown in Table 6-4 and 6-5. Further study of the north part of ICB may lead to the establishment of LAs for this area. The waste load allocation for the rolling 30-day geometric mean during any time period or monitoring site at ICB is zero (0) days of allowable exceedances.

6.1.3 Natural Subwatersheds

The bacteria indicators used to assess water quality are not specific to human sewage. Fecal matter from wildlife and birds can be a source of elevated levels of bacteria, and vegetation can be a source of elevated levels of total coliform bacteria, specifically.

Based on historical data, even the most undeveloped subwatersheds of SMB occasionally exceed the single sample targets outlined in Section 3. For example, Leo Carrillo Beach (LCB) has an associated subwatershed, Arroyo Sequit Canyon, that is 98% open space. Arroyo Sequit Canyon is approximately 12 square miles in size and has the highest percentage (98%) of open space in comparison to the other subwatersheds in Santa Monica Bay. LCB exceeded one or more of the single sample targets on average 0% of the summer dry-weather days sampled, 3% of the winter dry-weather days sampled, and 22% of the wet-weather days sampled over the 5-year period from November 1995 to October 2000.

Based on these findings, strictly applying the single sample targets identified in Section 3 would likely require implementing agencies to capture or treat dry and wet-weather runoff from natural areas. It is not the intent of this TMDL to require diversion of natural coastal creeks or to require treatment of natural sources of bacteria from undeveloped areas. Therefore, the implementation procedure for the recently-adopted bacteria objectives for REC-1 waters and the WLA approach proposed herein set allowable exceedance days based on bacteriological water quality conditions that are achievable at reference beach(es) associated with largely undeveloped subwatershed(s) within Santa Monica Bay or based on antidegradation principles.

6.2 Allowable Exceedance Days

As previously described in Section 3, staff proposes to set the number of allowable exceedance days for each monitoring site to ensure that two criteria are met (1)

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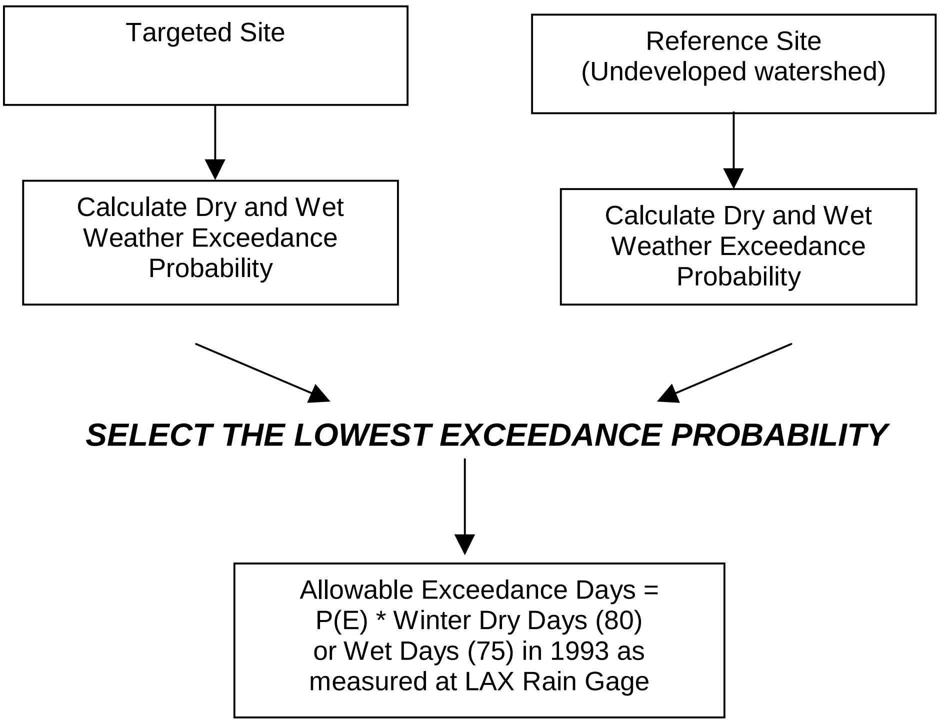
the same as the numeric targets in this TMDL – which, when exceeded during the period April 1 to October 31, result in posting a beach with a health hazard warning (California Code of Regulations, Title 17, Section 7958).

bacteriological water quality is at least as good as that of a largely undeveloped system, and (2) there is no degradation of existing bacteriological water quality.

Staff ensures that the two criteria above are met by using the smaller of two exceedance probabilities for any monitoring site multiplied by the number of dry days or wet days for the critical condition (discussed in Section 5.1). An exceedance probability, P(E), is simply the probability that one or more single sample targets described in Section 3 will be exceeded at a particular monitoring site, based on historical data. The flow diagram below illustrates the decision-making process for determining allowable exceedance days at a monitoring site.

Figure 6-1. Decision-Making Process for Determining Waste Load Allocations (expressed as allowable exceedance days)



For any one monitoring site, two exceedance probabilities are compared and the lowest one is selected (1) the dry-weather or wet-weather exceedance probability in the reference system, P(E)R and (2) the dry-weather or wet-weather exceedance probability based on historical bacteriological data at that particular site, P(E)i. (In other words, if P(E)R is greater than P(E)i, then P(E)i will apply to that particular site (i.e., the site-specific exceedance probability would override the "default" exceedance probability of the reference system)). Next, the chosen dry-weather or wet-weather exceedance probability is multiplied by the dry or wet days in the reference year as measured at the LAX meteorological station.

Below, we provide background information and justification for the two steps in the process described above. First, we describe how the dry and wet-weather exceedance probabilities for the monitoring sites were calculated. Then we discuss how these exceedance probabilities are translated into allowable exceedance days for each time period at the targeted monitoring site, including justifications for the proposed reference beach and reference year.

Step 1: Calculating Dry-Weather and Wet-Weather Exceedance Probabilities
The dry-weather exceedance probability is simply the probability that one or more single sample targets will be exceeded on a dry day at a particular location. The wet-weather exceedance probability is simply the probability that one or more single sample targets will be exceeded on a wet day at a particular location.

The most recent five or six years of monitoring data (November 1, 1995 to October 31, 2001) were used to determine the exceedance probability for each monitoring site for each of the three time periods of concern (i.e., summer dry-weather, winter dry-weather, and wet-weather). Samples were identified as dry or wet-weather samples using rainfall data from LAX. See Table 7-1 for the exceedance probabilities for each time period of concern at each monitoring location, based on historical data.

Table 6-1. Summary of Calculated Exceedance Probabilities

EXCEEDANCES PROBABILITIES		**(May 98 to Dec 02)**		
Location ID	**Monitoring Location**	**Summer dry weather exceedance probability**	**Winter dry weather exceedance probability**	**Wet weather exceedance probability**
DHS (010)*	Leo Carrillo Beach, at 35000 PCH - weekly	0.00	0.03	0.22
CB1	Inner Cabrillo Beach, north side - daily	0.07	0.10	0.23
CB2	Inner Cabrillo Beach, south side - daily	0.39	0.55	0.74
HW07	Main Ship Channel	0.04	0.08	0.20

* November 1, 1995 - October 31, 2001

Step 2: Calculating Allowable Exceedance Days at a Targeted Location

To determine allowable exceedance days, the smaller of the two exceedance probabilities – that of the targeted site or the reference site – is selected to use in subsequent calculations.

Staff proposes to use Leo Carrillo Beach (LCB) as the reference site. To translate the exceedance probabilities into allowable exceedance days and exceedance-day reductions, staff proposes to use the number of wet weather days and the number of dry weather days in the 90th percentile storm year, based on rainfall data from the Los Angeles International Airport (LAX) meteorological station. Justification for this decision is provided below.

6.2.1 Justification for reference beach

Three criteria were used to rate candidate sites for selection as the reference beach. These were (1) percentage of undeveloped land in the watershed, (2) presence of a freshwater outlet to the beach, and (3) availability of historical monitoring data. Leo Carrillo Beach and its associated drainage, Arroyo Sequit Canyon, best met these criteria. Arroyo Sequit Canyon has the largest percentage of land area in open space (98%) relative to all other Santa Monica Bay subwatersheds, LCB has a freshwater outlet (Arroyo Sequit) to the beach, and there is an existing monitoring site at the beach (see Table 7-2). Furthermore, field surveys by Regional Board staff have confirmed that there is very little evidence of anthropogenic impact in most of this relatively large subwatershed. The reference system will be re-evaluated as part of the fourth year revision of the TMDL.

Table 6-2. Comparison of Subwatershed Size and Percent Open Space

Subwatershed	Open	Total Land Area (acres)	Size Rank	Open Space Rank
Arroyo Sequit	98.0%	7,549	5	1
Solstice Canyon	97.2%	2,841	14	2
Pena Canyon	97.1%	608	27	3
Tuna Canyon	96.4%	1,013	24	4
Nicholas Canyon	91.6%	1,235	22	5
Latigo Canyon	91.0%	813	25	6
Encinal Canyon	90.5%	1,794	21	7
Las Flores Canyon	90.4%	2,897	13	8
Los Alisos Canyon	90.3%	2,396	16	9
Topanga Canyon	89.8%	12,575	1	10
Corral Canyon	89.6%	4,280	10	11
Escondido Canyon	88.6%	2,295	18	12
Trancas Canyon	88.4%	6,514	7	13
Zuma Canyon	85.8%	6,339	8	14
Castlerock	85.0%	4,976	9	15
Carbon Canyon	84.7%	2,320	17	16
Piedra Gorda Canyon	81.9%	644	26	17
Ramirez Canyon	78.3%	3,334	12	18
Santa Monica Canyon	77.6%	10,088	2	19
Pulga Canyon	76.6%	1,955	19	20
Santa Ynez	46.1%	1,203	23	21
Palos Verdes	33.6%	10,023	3	22
Santa Monica	13.0%	8,850	4	23

Subwatershed	Open	Total Land Area (acres)	Size Rank	Open Space Rank
Dockweiler	12.8%	6,573	6	24
Redondo	5.5%	3,544	11	25
Marina del Rey	4.8%	1,855	20	26
Hermosa	2.9%	2,624	15	27

6.2.1.1 **Justification for critical condition (reference year)**

Based on an examination of historical rainfall data from the Los Angeles International Airport (LAX) meteorological station,[2] staff propose using the 90th percentile storm year[3] in terms of wet-weather days as the critical condition for determining the allowable wet-weather exceedance days. The reference year of 1993 was chosen because it is the 90th percentile year in terms of wet-weather days, based on 54 storm years (1948-2001) of rainfall data from LAX (see Appendix A). In the 1993 storm year, there were 75 wet-weather days, therefore, there were 290 dry days, 80 of which occurred during the winter months.[4] By selecting the 90th percentile year, we avoid creating a situation where the reference beach frequently exceeds its allowable exceedance days (i.e., 9 years out of 10, the number of exceedance days at the reference beach should be less than the *allowable* exceedance days at the reference beach).[5]

6.3 Translating exceedance probabilities into estimated exceedance days during the critical condition

The estimated number of exceedance days during the critical condition (reference year) was calculated for each site by multiplying the site-specific exceedance probability by the estimated number of dry or wet days in the reference year. The site-specific exceedance probability is taken directly from the historical data analysis, as listed in Table 6-1. Based on 54 storm years of rainfall data from LAX meteorological station, 1993 is the reference year for both dry and wet weather.

$$E_{CC} = P(E)_i * days_{1993} \quad \text{(Equation 6.1)}$$

Where E_{CC} is the estimated number of exceedance days under the critical condition and $P(E)_i$ is the average probability of exceedance for any site. The average exceedance probability is appropriate since the weekly sampling is systematic and the rain events are randomly distributed; therefore, sampling will be evenly spread over the dry-weather and wet-weather events (i.e., the rain day, day after, 2nd day after, 3rd day after).[6]

To estimate the number of exceedance days during the reference year *given a weekly sampling regime*, the number of days was adjusted by solving for *x* in the following equation:

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[2] Staff used data from the LAX meteorological station, since it has the longest historical rainfall record.

[3] The "storm year" is defined as November 1 to October 31, in order to be consistent with AB-411 implementing regulations.

[4] For comparison, in the 1993 storm year, there were 41 *days of rain*, which represented the 75th percentile, and 22.93 *inches of rain*, representing the 94th percentile, for the historical rainfall record at LAX.

[5] Conversely, if we were to select the 10th percentile year in terms of wet days to set the allowable exceedance days, the reference beach could foreseeably exceed the allowable exceedance days 9 years out of 10.

[6] Also, note that SCCWRP found no correlation between the day of the week and the percentage of samples exceeding the single sample objectives (Schiff *et al*., 2002, p. 40).

$$\frac{days_{1993}}{365\ \text{days}} = \frac{x}{52\ \text{weeks}} \qquad \text{(Equation 6.2)}$$

Using these equations, the exceedance probability of the reference beach is translated to exceedance days as follows. Analysis of historical monitoring data for Leo Carrillo Beach, the reference beach, shows that summer dry-weather exceedance probability is 0.00, the winter dry-weather exceedance probability is 0.03, and the wet-weather exceedance probability is 0.22. Per Equation 6.1, the number of summer dry-weather exceedance days is zero (0) at Leo Carrillo Beach, therefore, no exceedances are allowed at any site during summer dry weather. The exceedance probability of 0.03, for winter dry-weather, is multiplied by 80 days, the number of winter dry-weather days in the 1993 storm year, per Equation 6.1 resulting in three (3) exceedance days. The exceedance probability of 0.22, for wet-weather, is multiplied by 75 days, the number of wet-weather days in the 1993 storm year at, per Equation 6.1 resulting in 17 exceedance days.

Staff recognizes that the number of winter dry-weather days and wet-weather days will change from year-to-year and, therefore, the exceedance probabilities of 0.03 for winter dry-weather and 0.22 for wet-weather will not always equate to 3 or 17 days, respectively. However, staff proposes setting the allowable number of exceedance days based on the reference year rather than adjusting the allowable number of exceedance days annually based on the number of dry or wet days in a particular year. This is because it would be difficult to design diversion or treatment facilities to address such variability from year to year. Staff expects that by designing facilities for the 90th percentile storm year, during drier years there will most likely be fewer exceedance days than the maximum allowable.

To estimating the number of exceedance days at Leo Carrillo Beach in the reference year under a weekly sampling regime for winter dry-weather and wet-weather, the number of days was adjusted by solving for x in Equation 6.2 as follows:

$$\frac{80\ days}{365\ days} = \frac{x}{52\ weeks} \qquad \text{(Equation 6.2 for winter dry-weather)}$$

$$\frac{75\ days}{365\ days} = \frac{x}{52\ weeks} \qquad \text{(Equation 6.2 for wet-weather)}$$

For winter dry-weather, solving for x equals 11.4, which is then multiplied by 0.03, resulting in one (1) exceedance day during winter dry-weather when weekly sampling is conducted. For wet-weather, x equals 10.7 multiplied by 0.22, results in three (3) exceedance days during wet-weather when weekly sampling is conducted.

The estimated exceedance days for all the other sites are calculated in the same way, using the site-specific exceedance probabilities for each time period.

For illustrative purposes, in Tables 6-3 through 6-5, for each monitoring site (and assuming a daily sampling regime), staff present the estimated number of exceedance days under the critical condition, the allowable number of exceedance days calculated as described above, and the necessary exceedance-day reduction for each time period.

Table 6-3. Estimated Summer Dry-Weather Exceedance Days in Critical Year, Allowable Exceedance Days, and Exceedance-Day Reductions, by Site

Monitoring Location	**Estimated no. of summer dry-weather exceedance days in critical year**	**Allowable no. of summer dry-weather exceedance days (daily sampling)**	**Estimated final summer dry-weather exceedance-day reduction**
Leo Carrillo Beach, at 35000 Pacific Coast Highway	0	0	0
Inner Cabrillo Beach, CB1	15	0	15
Inner Cabrillo Beach, CB2	83	0	83
Main Ship Channel, HW07	9	0	9

The WLA of zero (0) exceedance days for summer dry-weather is further supported by the fact that the California Department of Health Services has established minimum protective bacteriological standards, the same as the numeric targets proposed in this TMDL. Which, when exceeded during the period of April 1 though October 31, are used to post beaches with health hazard warnings (California Code of Regulations, Title 17, Section 7958). In order to fully protect public heath and prevent beach postings during this period, staff does not propose to change the zero exceedance days during summer dry-weather.

Table 6-4. Estimated Winter Dry-Weather Exceedance Days in Critical Year, Allowable Exceedance Days, and Exceedance-Day Reductions, by Site

Monitoring Location	Estimated no. of winter dry-weather exceedance days in critical year	Allowable no. of winter dry-weather exceedance days (daily sampling)	Estimated final winter dry-weather exceedance-day reduction
Leo Carrillo Beach, at 35000 Pacific Coast Highway	3	3	0
Inner Cabrillo Beach, CB1	8	3	5
Inner Cabrillo Beach, CB2	44	3	41
Main Ship Channel, HW07	7	3	4

For Inner Cabrillo Beach and the Main Ship Channel, the estimated exceedance-day reductions during winter dry-weather represents a 85% reduction in the expected number of exceedance days that would occur under the defined critical condition. For individual locations, the exceedance-day reductions range from a maximum of 41 days to 3 days. The allowable winter dry-weather exceedance days at all sites is a maximum of three (3) days.

Table 6-5. Estimated Wet-Weather Exceedance Days in Critical Year, Allowable Exceedance Days, and Exceedance-Day Reductions, by Site

Monitoring Location	**Estimated no. of wet-weather exceedance days in critical year (90^{th} percentile)**	**Allowable no. of wet-weather exceedance days (daily sampling)**	**Estimated final wet-weather exceedance-day reduction**
Leo Carrillo Beach, at 35000 Pacific Coast Highway	17	17	0
Inner Cabrillo Beach, CB1	18	17	1
Inner Cabrillo Beach, CB2	56	17	39
Main Ship Channel, HW07	15	15	0

For the Inner Cabrillo Beach and Main Ship Channel, the estimated exceedance-day reductions during wet-weather represents a 45% reduction in the expected number of exceedance days that would occur under the defined critical condition. For individual locations, the exceedance-day reductions range from a maximum of 39 days to 0 days (in the Main Ship Channel, where the antidegradation standard is applied). The range of allowable wet-weather exceedance days is 15 to 17 days.

7 MARGIN OF SAFETY

An explicit margin of safety has been incorporated as the load allocations will allow exceedances of the single sample standards no more than 5% of the time on an annual basis, based on the cumulative allocations proposed for dry and wet weather in the Allocations Section below. Currently, the Regional Board concludes that there is water quality impairment if more than 10% of samples at a site exceed the single sample bacteria objectives annually.

7.1 BACTERIAL DEGRADATION

Based on three experiments conducted to mimic natural conditions in or near Santa Monica Bay, two in marine water and one in fresh water, bacterial degradation was shown to range from hours to days. Transport time from the subwatersheds of Los Angeles Harbor during wet-weather is short. Therefore, the conclusion is that bacteria degradation is not fast enough to greatly affect bacteria densities in the wave wash during wet-weather. Based on the results of the marine water experiments, the model assumes a first-order decay rate for bacteria of 0.8 d-1 (or 0.45 per day). (Degradation rates were shown to be as high as 1.0 d-1.) (Noble *et al.*, 1999)

8 CRITICAL CONDITIONS

The critical condition in a TMDL defines an extreme condition for the purpose of setting allocations to meet the TMDL numeric target. While a separate element of the TMDL, it may be thought of as an additional margin of safety such that the allocations are set to meet the numeric target during an extreme (or above average) condition.[7] Unlike many TMDLs, the critical condition for bacteria loading is not during low flow conditions or summer months, but rather during wet weather. This is because intermittent or episodic loading sources such as surface runoff can have maximal impacts at high (i.e. storm) flows (US EPA, 2001). Local and bight-wide shoreline monitoring data show a higher percentage of daily exceedance of the single sample targets during wet weather, as well as more severe bacteriological impairments indicated by higher magnitude exceedances and exceedances of multiple indicators (Noble *et al*., 2000a, Schiff *et al*., 2001).

To more specifically identify the critical condition within wet weather, in order to set the allowable number of exceedance days (described in Section 6, Waste Load Allocations and Load Allocations), staff propose using the 90th percentile storm year in terms of wet days as the reference year.[8] Staff selected the 90th percentile year for several reasons. First, selecting the 90th percentile year avoids an untenable situation where the reference system is frequently out of compliance. Second, selecting the 90th percentile year allows responsible jurisdictions and responsible agencies to plan for a ‘worst-case scenario’, as a critical condition is intended to do. Finally, the Regional Board expects that there will be fewer exceedance days in drier years, since structural controls will be designed for the 90th percentile year.

The 90th percentile storm year in terms of wet days was identified by constructing a cumulative frequency distribution of annual wet weather days using historical rainfall data from LAX from 1947-2001 (see Appendix A). This means that only 10% of years should have more wet days than the 90th percentile year. The 90th percentile year in terms of wet days was 1993, which had 75 wet days. The number of wet days was selected instead of total rainfall because a retrospective evaluation of data showed that the number of sampling events during which greater than 10% of samples exceeded the fecal coliform objective on the day after a rain was nearly equivalent for rainstorms less than 0.5 inch and those greater than 0.5 inch, concluding that even small storms represent a critical condition (Noble *et al*., 2000a). This is particularly true since the TMDL’s numeric target is based on number of days of exceedance, not on the magnitude of the exceedance.

9 IMPLEMENTATION

[7] Critical conditions are often defined in terms of flow, such as the seven-day-ten-year low flow (7Q10), but may also be defined in terms of rainfall amount, days of measurable rain, etc.
[8] The storm year is defined as November 1 to October 31 to be consistent with the periods specified in AB411.

One of the most challenging aspects of this TMDL is the need to balance the competing uses at the MSC and ICB and within ICB itself. The predominant use of the Main Ship Channel is for navigation, whereas Inner Cabrillo Beach supports wildlife habitat as well as extensive use for water contact recreation. Although navigation is the main use of the MSC, it is anticipated that the need for pier and ship maintenance along the Main Ship Channel may require full body contact with the waters of the MSC. The need for balancing beneficial uses also exists at ICB which has provided both water contact recreation and wildlife habitat for more than seven decades. Development of an effective implementation plan to address the bacterial impairment at ICB is further challenging because ICB is enclosed and the bacterial contamination which reaches ICB is not effectively diluted as it would be at an open beach.

Further complicating the attainment of water quality standards, is the wide variety of sources that impact ICB and the MSC. Based on the Source and Linkage Analyses, it does not appear that elimination of any one source will be sufficient to attain water quality standards. Based on this assessment, Regional Board staff recommends a tiered implementation plan as outlined below because it is cost effective and will allow evaluation of specific actions before other actions are initiated. We expect that responsible parties will be able to continually improve management policies and practices by learning from outcomes of programs in place and as results of additional or continued monitoring are obtained.

The regulatory mechanisms used to implement the TMDL will include the Los Angeles County Municipal Storm Water NPDES Permit (MS4), general and individual NPDES permits, and the authority contained in Sections 13263 and 13267 of the Water Code. Each NPDES permit assigned a WLA shall be reopened or amended at reissuance, in accordance with applicable laws, to incorporate the applicable WLAs as a permit requirement. Load allocations for nonpoint sources will be implemented within the context of this TMDL.

9.1 Implementation Strategies and Schedule

The key objectives of the Implementation Plan of this TMDL are to attain water quality standards while maintaining and balancing the existing uses of ICB and the MSC of Los Angeles Harbor. Based on the public outreach regarding this TMDL, Regional Board staff has prioritized the Implementation Plan to focus on attainment of water quality standards at the existing swimming area.

The City of Los Angeles, Port of Los Angeles, has received a State Water Resources Control Board Clean Beaches Initiative grant to determine the feasibility of improving water quality conditions in the vicinity of Inner Cabrillo Beach and has begun an assessment of sources and interim and permanent alternatives for improving water quality. This TMDL has been written to take advantage of the work and schedule already in place, as appropriate.

The Porter Cologne Water Quality Control Act prohibits the Regional Board from prescribing the method of achieving compliance with water quality standards, and likewise TMDLs. Below, staff have identified some potential implementation strategies; however, there is no requirement to follow the particular strategies proposed herein as long as the maximum allowable exceedance days for each time period are not exceeded. The City of Los Angeles is responsible for meeting the TMDL requirements for Inner Cabrillo Beach. The County of Los Angeles and the City of Los Angeles are responsible for meeting the TMDL requirements in the Inner Harbor and Main Ship Channel. These agencies may decide how to achieve the necessary reductions in exceedance days at each location by employing one or more of the implementation strategies discussed below or any other viable strategy.

The Implementation Plan is broken into three tiers

1. Immediate Actions - Remedial actions and Best Management Practices (BMPs) which have already been identified as necessary and which are low cost or for which funding has been identified. This would include improved water management at the beach, specifically, prohibition of sidewalk washing or irrigation which leads to runoff, an increased number of and more frequent emptying of trashcans at ICB, rehabilitated sanitary sewer lines at the Bathhouse and diversion of the storm drain which drains directly to ICB. The improvement of sanitary sewers and diversion of storm drains has already begun under the Port of Los Angeles Clean Beaches Initiative Grant. These actions should be taken within the first year of the effective date of the TMDL and should result in immediate improvements to the water quality at the beach.

2. Further Study and Development of Further BMPs – Several issues for this TMDL require further investigation before actions can be taken.

a) The extent of exceedances of water quality standards at the recreational area north of the swimming beach near the Youth Sports Camp which is used for water contact recreation, if not actually swimming, is not known. There is no current monitoring along that shoreline and there has been only infrequent measurements of bacteria in the waters off the beach. The City will conduct a special study to determine the frequency of bacterial exceedances and will determine what actions may be required to reduce exceedances in this area.

b) Identification, evaluation and implementation of additional, more complex BMPs for the swimming beach of Inner Cabrillo Beach are needed. Several actions which are currently being evaluated by the Port of Los Angeles (under Clean Beaches Initiative) include sand washing or rotation of sand to drying areas. Consideration of other actions may be warranted such as enlargement of the bird exclusion structure, management of feral cat population, alternative beach cleaning schedules etc. Careful assessment of the advantages and disadvantages of each of these actions will have to be made before action can be taken, however. For instance, while reduction of birds on the beach by expanding the bird exclusion device would likely reduce the number of exceedances there would also be a reduction in valuable wildlife habitat and educational value.

c) Identification of BMPs to reduce storm drain contributions to bacterial contamination from the storm drains in the Inner Harbor are also needed. The small survey of storm drain discharges conducted by the Regional Board (Los Angeles Regional Water Quality Board, 2004) indicated some dry weather and heavy wet weather introduction of bacteria to the Inner Harbor from storm drains. In December 2001, the Los Angeles County Municipal NPDES Storm Water Permit was re-issued jointly to Los Angeles County and 84 cities including the City of Los Angeles, as co-permittees. Future storm water permits will be modified in order to address implementation and monitoring of this TMDL and to be consistent with the waste load allocations of this TMDL.

After these BMPs are put in place, a thorough assessment of the effectiveness of the BMPs and the achievement of target numbers of exceedance days will be required to evaluate the necessity of actions in the third tier.

3. Structural Actions at Inner Cabrillo Beach -
The City of Los Angeles, Port of Los Angeles has already begun to develop alternatives as discussed in draft engineering reports developed under their Clean Beaches Initiative Grant (City of Los Angeles, 2004).

We have categorized the alternatives as physical, chemical or combined alternatives.

1. **Physical**

a. **Increasing the water depth in the Inner Cabrillo Beach Basin**
This alternative would take advantage of the assimilative capacity of the tidal circulation and would provide mixing and dilution to the polluted area through natural dynamic tidal flushing. At Cabrillo Beach, the tidal range varies from +4.7 ft to –0.9 ft (with respect to mean lower low water level (MLLW)) and the highest values for total coliform, *E. coli*, and enterococcus were in samples collected at ankle depth (about 5 inch) whereas all knee and chest level counts were below water quality standards. Thus, this tidal range could provide sufficient dilution to reduce or remove the bacteria even in the ankle depth for at least 8 hours of a tidal cycle (12 hours).

Increasing the water depth could improve the tidal flushing in the Inner Cabrillo Beach Basin such that dilution due to tidal flushing would occur. The tidal flow rate into and out of the Basin is not strong, approximately 200 cfs to 300 cfs. Inner Cabrillo Beach still exceeds the water quality standards under this tidal flushing. There are two possibilities that explain the continued exceedances, first, the sampling time could be in the low tidal flushing period and second, the capability of tidal flushing is not sufficient to remove or reduce the bacteria. The first possibility is unlikely since monitoring samples are taken at the same time everyday so that they would be taken at a different part of the tidal cycle everyday. It is likely that the present tidal flushing regime is simply inadequate. It may be possible, therefore, to enhance the capability of tidal flushing by increasing water depth. If this alternative is considered, the impact to the marine habitats, particularly eelgrass, and impacts to beach stability would have to be fully understood. In addition, the impact to the recreational uses would have to be assessed, as deeper water might be less safe or desirable to swimmers.

b. **Build a jetty starting from the end of boat launch jetty and extended into the Inner Basin**

This mechanism would also work by increasing the circulation and tidal flushing in the Inner Basin such that dilution of bacteria contamination from the Inner Cabrillo Beach shoreline would occur. The measured currents in the Inner Cabrillo Beach were very weak. The maximum recorded current was 12 cm/sec at CM1. In order to enhance the tidal circulation in the Inner Basin, a new jetty starting from the end of boat launch jetty and extended into the Inner basin to reduce the width of entrance of tidal flow and create a local eddy, and thus to produce more energetic circulation. This idea would need to be proved or justified by a hydraulic model or numerical model.

c. **Increase Circulation with Pumps**

This alternative could consist of constructing pipes through the breakwater and using pumps to move cleaner water to the beach. The continuous flow provided by pumps would be effective at reducing bacterial concentrations throughout the tidal cycle. Pumping water to reduce bacterial concentrations has been considered in other protected beaches, also (City of San Diego, 2003a; 2003b; 2003c).

d. Breakwater Modification

A breach or a conduit through the San Pedro breakwater could be made to allow greater circulation to the beach. This alternative was modeled in the Army Corps of Engineers study (US Army Corps of Engineers, 2002). It was found that such an opening would have some positive effect on waters in the outer Harbor but little impact directly at the beach.

2. **Chemical**

Chemical disinfection is widely used in the water and wastewater industry to reduce bacterial counts. Chlorine is still the most used chemical disinfectant but ozone is also widely used. While these chemicals will kill contaminating bacteria they also will kill naturally occurring bacteria and other plant and animal life. Chemical disinfection would not be appropriate because of the potential to kill much other natural flora and fauna in the Inner Basin.

3. **Combined**

Sub-surface Water Extraction and Treatment from the Inner Cabrillo Beach Shoreline Area

This concept is to use a combined method of physical and chemical approaches to reduce or remove the bacterial contamination from the Inner Cabrillo Beach shoreline. An underground collection tank would be built along the shoreline and the water sprayed to clean the contaminated area in the early morning or when it is needed and the polluted water allowed to flow into the underground collection tank. The unclean water would be pumped or naturally flow into a nearby treatment facility or to an outfall through a pipeline into the Basin. The advantage of this alternative is that the shoreline would be clean enough to support REC-1 uses and, in addition, there would be no reduction in wildlife habitat value.

9.2 IMPLEMENTATION SCHEDULE

The proposed implementation schedule shall consist of a phased approach as discussed below and outlined in Table 9-1.

Compliance and monitoring for ICB and the MSC is based on current water quality and practices at ICB and the MSC as measured at existing monitoring stations. Monitoring is to continue at the existing locations and current frequency.

Six months after the effective date of the TMDL, the City of Los Angeles will submit a Work Plan to address the Tier I BMPs and source control measures at Inner Cabrillo Beach. Implementation of the Tier I BMPs will be completed within six months of the TMDL effective date, and implementation of the Tier I Source Control Measures will be completed within twelve months of the TMDL effective date.

As described above, two special studies area required to address issues for which data are insufficient to determine appropriate implementation. These special studies include assessment of water quality in the northern area of Inner Cabrillo Beach, and further assessment of water quality in the MSC. Work plans for these special studies are due within six months of the effective date of the TMDL.

For the MSC, the results of the special studies will be used to develop a work plan for mitigating bacterial loading from storm drains that drain to the inner harbor. Regional Board staff expect that the analysis will include source control and diversion to sanitary sewers during dry weather. Implementation of the storm drain plan is to be completed within five years of the effective date of the TMDL.

To be consistent with the SMB beaches TMDLs, the Regional Board intends to revise this TMDL, in conjunction with the revision of the SMB beaches TMDLs. The SMB beaches TMDL is scheduled to be revised within the next four years: to re-evaluate the allowable winter dry-weather and wet-weather exceedance days based on additional data on bacterial indicator densities in the wave wash; to re-evaluate the reference system selected to set allowable exceedance levels; and to re-evaluate the reference year used in the calculation of allowable exceedance days.

Until the TMDL is revised, the allowable number of winter dry-weather and wet-weather exceedance days will remain as presented in Table 9.2. Revising the TMDL will not create a conflict in the interim, since the TMDL does not require compliance during winter dry-weather or wet-weather until five years from the effective date of the TMDL. Therefore, the allowable exceedance days for winter dry-weather and wet-weather will be revised as necessary before the compliance deadlines. Additionally, this TMDL will be reconsidered within four years of the effective date to address issues that are specific to the bacterial impairments of the Los Angeles Harbor.

Table 9.1 Inner Cabrillo Beach & Main Ship Channel Bacteria TMDL: Significant Dates

Implementation Action	Responsible Party	Date
Implementation (ICB): Submit Work Plan to Implement Best Management Practices and Source Control at ICB for Executive Officer Approval including, but not limited to storm drain repair and reroute; inspect and repair gravity sewer line; implement sand cleaning; repair bird exclusion structure; education and signage. (Tier 1)	• City of Los Angeles	Six months after Effective Date of TMDL.
Implementation (ICB): Implement Best Management Practices at ICB including trash receptacles and educational signage. (Tier 1)	• City of Los Angeles	Six months after Effective Date of TMDL
Special Studies (ICB): Submit work plan to assess water quality in the northern area of Inner Cabrillo Beach for Executive Officer approval including a plan to monitor northern ICB and assess the discharge from storm drains into the Saltwater Marsh (Tier 2).	• City of Los Angeles	Six months after Effective Date of TMDL.
Special Studies (MSC): Submit work plan to assess water quality in the Inner Harbor for Executive Officer approval including a plan to monitor in proximity to selected storm drains. If appropriate, include an analysis of the feasibility of conducting a UAA for the REC-1 and SHELL uses. (Tier 2).	• City of Los Angeles • County of Los Angeles	Six months after Effective Date of TMDL.
Implementation (ICB): Submit work plan for Tier 2 BMPs for Executive Officer approval, including but not limited to alteration of bird exclusion structure, control of sources from cat population, and sand management. (Tier 2)	• City of Los Angeles	Six months after Effective Date of TMDL
Implementation (ICB): Complete implementation of Source Control at ICB including, but not limited to storm drain repair and reroute; inspection and repair gravity sewer line; trash disposal, sand cleanup; and repair bird exclusion structure. (Tier 1)	• City of Los Angeles	Twelve months after Effective Date of TMDL

Compliance (ICB): After implementation of Tier 1 and 2 actions, submit results of monitoring to determine degree of compliance with allowable exceedance days. (Tier 3)	• City of Los Angeles	Two years after Effective Date of TMDL
Implementation (MSC): Based on the results of the MSC special studies and compliance evaluation, submit Work Plan for Executive Officer approval for source control or diversion of storm drains that are found to be sources of bacterial loading to the MSC.	• City of Los Angeles • County of Los Angeles	Two-1/2 years after Effective Date of TMDL
Implementation (ICB): If compliance is not achieved at the southern portion of Inner Cabrillo Beach, provide report to be approved by the Executive Officer of Tier III actions, to include but not be limited to, nearshore circulation or treatment of shallow water improvements, with a time schedule to attain water quality objectives. (Tier 3)	• City of Los Angeles	Three years after Effective Date of TMDL
Regional Board shall reconsider this TMDL to: a) refine allowable exceedance days based on additional data on bacterial indicator densities b) re-evaluate the reference system selected to set allowable exceedance levels, including a reconsideration of whether the allowable number of exceedance days should be adjusted annually dependant on the rainfall conditions and an evaluation of natural variability in the reference system(s), and if an appropriate reference system cannot be identified for this enclosed harbor, evaluate using the 'natural sources exclusion approach subject to antidegradation policies' rather than the 'reference system/antidegradation' approach, c) re-evaluate the reference year used in the calculation of allowable exceedance days, and d) Re-evaluate whether there is a need for further clarification or revision of the geometric mean implementation provision. e) Evaluate the feasibility of a natural sources exclusion for the non-swimming portion of ICB	• Regional Board	Four years after Effective Date of TMDL, or at the time of reconsideration of the Santa Monica Beaches Bacteria
Final Compliance (MSC): Within five years of the effective date of the TMDL, there shall be	• City of Los Angeles • County of Los	Five years after Effective Date of

no exceedances in excess of the numbers in Table 6-3 and 6-4 of the single sample limits at any location during summer dry-weather (April 1 to October 31) or winter dry-weather (November 1 to March 31) and the rolling 30-day geometric mean targets must be achieved.	Angeles	TMDL
Implementation (ICB): All tier 3 remedies to be completed within five years of the Effective Date of the TMDL. (Tier 3)	• City of Los Angeles	Five years after Effective Date of TMDL
Final Compliance (ICB): Within five years of the effective date of the TMDL, there shall be no allowable exceedances of the single sample limits at any location during any of the periods (Tables 6-3, 6-4 and 6-5) and the rolling 30-day geometric mean targets must be achieved.	• City of Los Angeles	Five years after the Effective Date of the TMDL

Table 9.2 Los Angeles Harbor Bacteria TMDL: Final Allowable Exceedance Days by Sampling Location

Compliance Deadline		**5 years after effective date**		**5years after effective date**		**5 years after effective date[2]**	
		Summer Dry Weather ^		Winter Dry Weather ^*		Wet Weather ^*	
		April 1 - October 31		November 1 – March 31		November 1 - October 31	
Station ID	Location Name	Daily sampling (No. days)	Weekly sampling (No. days)	Daily sampling (No. days)	Weekly sampling (No. days)	Daily sampling (No. days)	Weekly sampling (No. days)
CB1; CB2	Inner Cabrillo Beach	0	0	3	1	17	3
HW 07	Main Ship Channel	0	0	3	1	15**	3**

Notes: The number of allowable exceedances is based on the lesser of (1) the reference system or (2) existing levels of exceedance based on historical monitoring data.
The allowable number of exceedance days during winter dry-weather is calculated based on the 10th percentile storm year in terms of dry days at the LAX meteorological station
The allowable number of exceedance days during wet-weather is calculated based on the 90th percentile storm year in terms of wet days at the LAX meteorological station.
^ A dry day is defined as a non-wet day. A wet day is defined as a day with a 0.1-inch or more of rain and the three days following the rain event.
* A revision of the TMDL is scheduled for four years after the effective date of the Los Angeles Harbor TMDL in order to re-evaluate the allowable exceedance days during winter dry-weather and wet-weather based on additional monitoring data and the results of the study of relative loading from sources including but not limited to storm drains, boats, birds and other nonpoint sources.
**The Main Ship Channel (HW07) is already meeting the allowable exceedance days for wet weather (15 days/daily sampling, 3 days/weekly sampling).

9.3 MONITORING

A compliance monitoring program is required for the TMDL, to assess compliance with the allowable exceedance days for the Inner Cabrillo Beach and the Main Ship Channel. Compliance and monitoring for ICB and the MSC is based on current water quality and practices at ICB and the MSC as measured at existing monitoring stations. Monitoring is to continue at the existing locations and current frequency.

If the number of exceedance days is greater than the allowable number of exceedance days, the City of Los Angeles (for ICB) or the City and the County of Los Angeles (at MSC) shall be considered out-of-compliance with the TMDL.

Additional monitoring is required to characterize water quality in the MSC and the northern portion of the ICB. As described in the Implementation Plan, the City of Los Angeles is responsible for developing a work plan to characterize the ICB area and the City and the County of Los Angeles are responsible for developing a work plan to characterize the MSC area.

9.4 SPECIAL STUDIES

The reference system characterization will allow the Regional Board to refine estimates of the “reference” level of exceedance, which is used to set allowable exceedance days at target beaches where the antidegradation criterion does not apply. As discussed in Section 7, the TMDL waste load allocations are set such that the number of exceedance days at a target beach should be the lesser of that observed in the reference system or the historical level of exceedance for the target beach. Regional Board staff selected Arroyo Sequit Canyon and Leo Carrillo Beach as the best candidate “reference” system for the purpose of setting the “reference” allowable exceedance days at this stage. Over the next few years, the Regional Board intends to work with the SMB Watershed Steering Committee and other agencies to re-evaluate the details of using a reference system approach. This evaluation will include assessing alternative reference systems and collecting data from these systems to better define the “reference” level(s) of exceedance observed in local natural systems during both wet and dry weather.

Based on the results of the monitoring plan for the northern portion of the ICB, the City may wish to revise the water quality objectives in this area based on a natural source exclusion. Under these circumstances, the City would be responsible for developing a work plan to develop the data necessary for the Regional Board to consider a natural sources exclusion for this area.

9.5 COST ANALYSIS

To estimate the cost of implementing the TMDL, staff has compiled the capital costs of diverting 10 major storm drains to a City of Los Angeles POTW and the operation and maintenance (O&M) costs of diverting the storm drains. During the Regional Board staff's dry weather survey of the Inner Harbor and the Main Ship Channel it was estimated that approximately 10 storm drains had measurable dry weather flow.

9.5.1 Storm Drain Diversion

The cost estimates for storm drain diversion to meet the wasteload allocations are based on the cost analysis for the Santa Monica Bay Pathogens TMDL and the Regional Board sampling of the MSC. The Santa Monica Bay dry weather TMDL estimated costs for low-flow diversion of the 27 major storm drains entering Santa Monica Bay during the period April 1 to October 31 are as follows. These costs are based on a report prepared by the City of Los Angeles (2001), discussions with staff at the City of Los Angeles, Bureau of Sanitation, and proposals submitted to the Regional Board and Santa Monica Bay Restoration Project under the Clean Beaches Initiative and Proposition 12. The annualized capital cost to construct 10 low-flow diversions is estimated at $717,386, assuming financing for 20 years at 7 percent. The operation and maintenance costs during the period from April 1 to October 31 for all 27 diversions are estimated at approximately $1.7 million. Based on a simple scaling ration, the operation and maintenance costs of diversion of 10 storm drains in the Inner Los Angeles Harbor is $630,000, and the total annualized cost is estimated at $1.34 million.

9.5.2 Inner Cabrillo Beach BMPs and Sanitary Sewer Replacement

Regional Board staff derived the following cost estimates for BMPs for Cabrillo Beach and upgrading existing sewage system at Inner Cabrillo Beach based on estimates provided by the City of Los Angeles personnel. Cost estimates were developed for cleaning up the beach by more frequent emptying of trash can, washing and rotation of sand to drying area, repairing the bird exclusion structures, and upgrading the existing sewage system at Inner Cabrillo Beach. Annual maintenance costs are estimated to be $50,000 to $75,000 for additional staff. To replace existing sewage system (¼ mile of 8 inches sewer line) to prevent any sewage spill which might contribute to bacteria sources is estimated to cost $20,000.

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